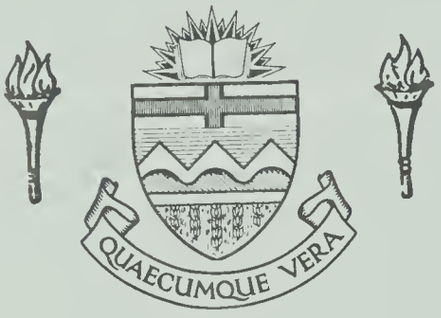

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THE UNIVERSITY OF ALBERTA

TEACHING RECEPTIVE VOCABULARY TO YOUNG MONGOLOID CHILDREN: A BEHAVIOR MODIFICATION STUDY

by

© L. RICHARD CROZIER

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Teaching Receptive Vocabulary to Young Mongoloid Children: A Behavior Modification Study" submitted by L. Richard Crozier in partial fulfilment of the requirements for the degree of Master of Education.

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Abstract

The principal purpose of the present investigation was to devise and to evaluate the effectiveness of an integration of programmed instruction and operant techniques in developing receptive vocabulary in young, non-institutionalized mongoloid children.

To achieve this purpose, a sample of ten subjects was drawn from the population of children with Down's syndrome (mongolism) presently enrolled in the beginning "sense training" program at the Winnifred Stewart School in Edmonton. The subjects were equated in pairs on the variables of sex, IQ, MA, and language age (LA). Subjects in each pair were assigned by chance to the experimental or comparison group.

All subjects were given a pretest based on all pictures of the Peabody Picture Vocabulary Test up to a ceiling of 10 failures in any 12 consecutive items. Those items failed in the pretest were selected as training stimuli for each member of the experimental group. The experimental subjects were given 40 sessions of individualized tutoring over an 8-week period. New stimuli were taught in groups of four in a carefully programmed sequence of small steps devised to keep the number of error responses at a minimum. Training provided for systematic reinforcement in the form of small bites of food or praise from the tutors contingent upon appropriate responding. The program incorporated parent education and cooperation.

Continuous, objective measures were taken in all training sessions and tests were applied before, during, and after treatment.

Both individual and group control methods were attempted.

Procedural effectiveness was assessed in terms of: attending behavior, levels of correct and incorrect responding, acquisition, and retention. In addition, an experimental probe was conducted to assess the effect of withdrawing primary reinforcement for a period of training. Attempts were also made to identify generalization effects related to training.

Analysis of the results indicated that an integration of programmed instruction and contingency management techniques had a significant positive effect on the learning of receptive vocabulary by the mongoloid children in the experimental group. Some implications for education and future research are discussed.

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L. R. C.

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Chapter 1

The use of operant techniques for modifying the behavior of the severely and profoundly retarded has become increasingly more common in recent years. Excellent and recent reviews of these studies (Hollis & Gorton, 1969; Gardner & Watson, 1969; Spradlin & Girardeau, 1966; Watson, 1967) indicate that this approach has been used quite successfully in developing many adaptive behaviors in low-functioning children.

An ever-increasing number of investigators (Homme, Baca, Cottingham, & Homme, 1968; Jordan, 1967; Michael, 1967) have indicated the need for a more comprehensive and increased application of operant conditioning techniques to the problems of low-functioning children. The most significant development in this respect is the recent policy statement from the American Psychological Association (1970) with respect to mental retardation:

> There is an urgent need for increased attention to educational and psychological research at the level of the infant and preschool child. Programs that maximize the limited abilities of the retarded must be developed and evaluated . . . it has been demonstrated frequently that with the appropriate application of psychological principles of learning and rehabilitation, a significant percentage of those now called "retarded" can become active, productive members of society . . . there is a body of psychological knowledge, only sporadically applied at this time, that could be used to improve the lives of even the most severely retarded (p. 268).

The Problem

One area which would appear to be deserving of future research with low-functioning children is language development. Facility with language appears essential and basic to the development of other adaptive behaviors. Delayed speech and language skills constitute a major impediment to human social, emotional, and vocational adjustment (Schiefelbusch, Copeland, & Smith, 1967).

Mongoloid children have repeatedly demonstrated severe deficits in this critical area of human functioning (Zisk & Bialer, 1968). The development and evaluation of training procedures suitable for enhancing language development would appear to be a very desirable goal for scientific research.

The purpose of the investigator in the present study was to focus on the problem of devising and applying systematic and integrated techniques in programming and operant conditioning for training receptive vocabulary in a group of young, non-institutionalized mongoloid children.

Background to the Problem

The study of mongolism as a separate pathological entity has been a focus of scientific interest since 1866 when J. Langdon Down first used the term "mongolism" to describe the condition. The term "mongolian idiot" which Down applied to these seemingly

similar children has persisted to this day in the literature and in the minds of many medical, educational, and psychological personnel.

In his introductory remarks to a symposium held on mongolism in 1953, Weingold (1953) pointed out that the labeling of a child as a "mongoloid" has many overtones extending far beyond the description of a clinical entity. Weingold emphasized that the educational process is made very difficult by the misconceptions concerning mongolism that are perpetuated in succeeding generations of professionals. These misconceptions are reflected in the attitudes of neighbors, parents, and even some teachers who view mongoloids as ineducable.

At the same symposium, Quaytman (1953) faced the question squarely by asking,"Is the hopeless prognosis given for all mongoloids by pediatricians, obstetricians and other medical workers based on scientific data or on self-perpetuating prejudice?" Quaytman noted that nearly all of the data on mongolism published in medical text-books are based on studies of institutionalized mongoloids in spite of the fact that 80 to 90 per cent of the mongoloid population is believed to live in the community. He questioned the validity of such data when applied to non-institutionalized mongoloids.

In his concluding remarks, Weingold (1953) had this to say:

> The labeling of a child as a "mongoloid" has many overtones, far beyond the description of a clinical entity . . . it is high time, indeed, that this problem be removed from the shadows, placed in the light of day and examined, not only as to its medical implications, but also educational and social. In short, let us see the "mongoloid" as a child, unblinded by an unfortunate name, and unhampered by outworn prejudices . . . where are the studies of mongol, mongolian, mongoloid children made in the community, in a normal environment? (p. 253).

The community based mongoloid child has usually been neglected in studies involving mongoloid subjects. After reviewing the literature on the educational aspects of mongolism, Blessing (1958) was struck by the dearth of material and research in this area. Blessing argued that the past neglect and bias associated with this group can no longer be tolerated in view of the new horizons opening up to community mongoloids as well as other trainable adults in the form of sheltered workshops and occupational training centers.

Fortunately, the past two decades have witnessed an increasing amount of research into many different aspects of mongolism. For example, McIntire, Menolascino and Wiley (1965) have reported data on the clinical aspects of mongolism gathered over a five-year period. Gibson (1967) has systematically examined the relation of mongoloid to parental intelligence. Several investigators have looked into the popularly held idea that mongoloid children have cheerful dispositions, exhibit unusual mimicry, and show indiscriminate affection to others. The results from these studies have been conflicting and inconclusive. Menolascino (1965) concluded that this "prince charming" characterization is a fairy tale description without empirical basis.

On the other hand, Moore, Thuline and Capes (1968) found evidence that mongoloids, as a group, tend to exhibit less maladaptive behavior than retarded peers without mongolism. This finding was supported by Johnson and Abelson (1969) in a recent study where the authors claim that their paper demonstrates that mongoloids more frequently exhibit a variety of adaptive, socially competent behaviors. However, Cornwell and Birch (1969), in a study involving

44 home-reared children with mongolism, found that the evidence clearly did not support a stereotyped view of children with mongolism. They state that in the past, an over-simplified answer has been provided by attributing to mongoloids a homogeneity of function which has tended to perpetuate the stereotype that they are "friendly, imitative, idiots." Several other investigators (Blount, 1968; Byck, 1968; Centerwall, 1960; Clausen, 1968) have supported the latter view.

One of the obvious problems with research of this type is that many of the studies were based on the study of institutional populations. In such populations, it is difficult to differentiate between consequences of institutionalization and intrinsic limitations in growth processes (Cornwell & Birch, 1969). The negative effects of institutionalization on development have been well-documented in the literature. Most recently, Shipe and Shotwell (1965) and Stedman and Eichorn (1965) have compared the growth and development of institutionalized and home-reared mongoloids during infancy and early childhood. In both instances, the home-reared groups were superior in terms of intellectual and social development. A general observation from all these studies is that early training is important and essential for later development (Gibson, 1967).

Another area which has stimulated increasingly more research in the past two decades is language development. One finding that is generally agreed upon by all observers is that the language development of mongoloid children is delayed compared to that of normal children of equivalent MA (Blanchard, 1963; Fishler, Share,

& Koch, 1964; Schlanger & Gottsleben, 1957; Strazzulla, 1953; Thompson, 1963; West, 1957). The majority of these studies has concentrated almost entirely on the "expressive" or speech aspects of language.

Prior to 1950, there was a paucity of studies dealing with the speech of the child with mongolism (Kramer, 1958). The 1950's presented a somewhat brighter picture when Kramer (1953) produced evidence to show that mongoloids were responsive to efforts aimed at improving their communicative abilities. Lubman (1955) lent support to Kramer's findings by showing that mongoloids could show more rapid and permanent progress in speech correction than "brain-injured" children of comparable IQ. This line of research was pursued by Kolstoe (1958), who showed that even mongoloids of relatively low intelligence could benefit from speech therapy. After reviewing these earlier studies, Zisk and Bialer (1968) noted that while these indications that progress is possible have lent impetus to research, so far very little has been accomplished concerning the understanding of the genesis of speech problems among mongoloid children and the effective treatment of these problems.

Another line of research has looked at differential language development in specific types of retardation (Lyle, 1959; Mein, 1961; Schlanger & Gottsleben, 1957). However, the comparison of the language development of mongoloid and non-mongoloid retardates has as yet produced only a few inconsistent conclusions (Spreen, 1965).

An important area which has generated little research is language comprehension or language reception. After having reviewed

all the relevant studies on language and communication up to 1960, Spradlin concluded: "Research into language and communication has been confined primarily to the study of speech. Systematic studies of the gestures or of the language comprehension of mental defectives are, in the main, absent (p. 513)."

More recently, Zisk and Bialer (1968) reviewed that portion of the literature dealing with language reception among mongoloids. They summarize their findings with the following statement:

> The general literature yields little of significance towards understanding of the mongoloid's receptive language problems . . . there is overall agreement that children with mongolism show delayed language development; but the behavior investigated is often broadly and vaguely defined (p. 39).

Zisk and Bialer found that except for a few studies which have explored receptive and expressive language from the standpoint of psycholinguistic function, the published reports on reception among mongoloid children have concerned themselves principally with the question of hearing ability (e.g., Fulton & Lloyd, 1968).

There is little doubt that impaired hearing interferes with acquisition of verbal symbols; indeed, all aspects of oral communication may be affected by hearing problems. Generally, hearing problems may consist of defects in: (1) auditory discrimination (the ability to distinguish between speech sounds); or, (2) auditory acuity (the ability to detect sounds per se). However, the entire question of the hearing ability of mongoloids remains very much open to further investigation (Zisk & Bialer, 1968).

Earlier attempts to analyze language and to develop language training programs have been limited by two major factors: (1) the absence of adequate theoretical models, and (2) the lack of

suitable evaluative instruments. Both these problems have been overcome to some extent in the past decade. The Parsons Language Sample (PLS) and the Illinois Test of Psycholinguistic Abilities (ITPA) have made a major contribution to the study of language by formally recognizing the distinction between language reception and language expression. As Spradlin (1967) points out, being able to understand language and being able to use it are not perfectly correlated. Some recent statistical evidence to this effect has been presented by Allen and Wallach (1969).

Standardized measures of receptive language have become widely used in recent years. Both the PLS and the ITPA have subtests which purport to measure receptive language. Other fairly well-known measures of receptive language include the Ammons Picture Vocabulary Test (APVT) and the Peabody Picture Vocabulary Test (PPVT).

Some major theoretical developments have also stimulated language research. The training of language behavior with low-functioning children has been facilitated by the component-content approach derived from the analysis of language provided by Skinner (1957). Skinner has suggested that the complex structure of verbal behavior can be separated into a series of component segments such as echoic behavior, auditory control, manding, tacting, and intraverbal sequence.

Another approach to language analysis has been suggested by the work of Osgood (1957). The ITPA is derived directly from Osgood's language and communication model. The ITPA, in turn, has resulted in the development of language training programs. For example, Karnes (1968) has presented a book of activities derived

from the ITPA model which are designed to help young children to develop language skills.

The problem of designing adequate language training programs is a formidable one. Spradlin (1963) has called for an empirical approach to language where language is construed as a set of responses subject to manipulative control. Viewed in this perspective, specific questions come into focus, such as: (1) To what behaviors shall the term language refer? (2) In what way are the classes of behaviors included under the label "language" related to each other? and (3) What are the variables which control the various classes of language behaviors?

Spradlin (1967) suggests that the first step in designing language training programs should be to establish the terminal behavior or behavioral goal of training. The next phase is the development of the intermediate steps. Spradlin goes on to say that once the terminal behavior and the guidelines for steps of the program are established, the program designer could then draw heavily from general procedures of behavior modification and programmed learning. These procedures would include immediate reinforcement of desired responses, careful control of the sequence of presentation of discriminative stimuli, use of thematic and formal prompts, and the systematic fading of cues. The careful specification of input and output variables would facilitate any necessary modifications of the program. Schiefelbusch (1965, 1967) has recommended a similar approach. He suggests that the clinician attempting to aid the child's communicative behaviors should: (1) determine baseline performance, (2) determine the kind of reinforcer that is effective,

(3) shape the desired behavior, and (4) prepare a program of steps appropriate to the child.

Michael (1967), while not looking at the question of language development in particular, has pointed out that twenty years of intensive research with animals has resulted in a rich assortment of techniques, concepts, and principles whose relevance extend to the behaviors of all organisms. It would appear that one major value of these research findings to those concerned with language training is to provide a basis for the analysis of behavior into its components and to provide for the assessment of the complexity of these different components.

Arguing along the same line, Jordan (1967) states that a desirable development would be the infusion of contemporary ideas on learning into the development of language. He also says that in a technological sense, both programmed learning and operant conditioning are certainly relevant to teaching language.

In summary, it appears desirable that further research efforts involving the mongoloid child be conducted in view of both practical and humanitarian considerations. Investigators generally agree that mongoloids, as a group, tend to exhibit a deficit in language functioning. Those studies in the area of language have generally focused on expressive language. The dearth of studies concerning the question of receptive language is rather surprising considering its obvious importance. A general observation in the development of language is that auditory comprehension or reception precedes productive or expressive speech (Myklebust, 1957). More

Chapter 2

Theoretical Framework

In this chapter the major principles and techniques of operant conditioning are reviewed and a general procedure for their application is presented. Viewed in this perspective, the purpose and need for the present study are discussed in detail.

Rationale

Retardation may be viewed as resulting from an interaction of heredity and environmental factors (Baumeister, 1967). While not denying the importance of organismic variables, the operant conditioning approach represents a concentrated attack on any environmental deficits which may be contributing to retarded functioning. Consequently, major emphasis is placed on arranging an *exceptional environment* to decrease retarded behavior.

Operant conditioning refers to a number of techniques that can be applied directly to the development of adaptive behavior. In discussing the rationale behind this approach, Nawas and Braun (1970) have stated:

> The behavior modifier does not speculate about the "cause," "degree of neurological impairment," or "dynamic factors" underlying the individuals condition. He does not "diagnose." He believes that all too often pinning down a "diagnostic label" becomes an end in itself; worse still, it imparts to the subject a set of expectancies that is shrouded in an aura of pessimism and doom (p. 3).

In the operant conditioning approach to retardation major emphasis is placed on behavior:". . . a retarded individual is one who has a limited repertory of behavior evolving from interactions

of the individual with the environmental contacts which constitute his history (Bijou, 1963, p. 262)." Therefore, as Throne (1970) has pointed out:

> The radical behaviorist agrees that the organism holds many wonders, but not that retardation is among them . . . for the radical behaviorist, a Down's Syndrome child is not retarded, in that he possesses 47 chromosomes instead of 46. He is retarded in that in comparison with chromosomally normal children, he underperforms on measures of intelligent and related behavior under average circumstances (p. 12).

Since behavior is viewed as a function of its consequences (Skinner, 1938), the basic strategy of the operant conditioning approach is to arrange suitable consequences to develop desired (nonretarded) behaviors. To the question, "How far can the application of contingent consequences go in modifying and controlling behavior, presumed to be due to 'mental retardation'? " Throne (1970) has replied:

> If behavior is a function of its consequences, then the possibility of controlling intelligent behavior is limited only by the possibilities of consequation: but these are infinite. Successful treatment demonstrates the determinativeness of the consequences which produce the outcome, but unsuccessful treatment reveals nothing about the infinitude of consequation as yet untried (p. 5).

Major Principles of Operant Conditioning

Implicit in the foregoing discussion is the basic principle of operant conditioning: the frequency of a response is subject to the consequences of that response. Whether behavior will, or will not be maintained, is dependent upon the characteristics of the environmental consequences of that behavior (Crosson, 1969). Hence, it becomes possible to bring the frequency of a response under control by identifying and arranging the reinforcement (consequences).

Three classes of consequential events may be identified: (a) positive reinforcers which have the effect of increasing the probability that behavior will occur, (b) negative reinforcers which have the effect of decreasing the probability of the behavior's occurrence, and (c) neutral stimuli which do not themselves affect behavior probability (Crosson, 1969).

Positive reinforcement. Environmental events or consequences which increase the frequency of a behavior are called reinforcing. Positive reinforcers are those stimuli which increase the frequency of a response by their presentation (Haring & Lovitt, 1967). The arrangement of an environment that will yield certain stimuli (reinforcing stimuli) only when specified behaviors occur is the process of providing reinforcement. Positive reinforcement is the most commonly used technique for increasing the frequency of adaptive or desirable behavior (Nawas & Braun, 1970). Bijou and Sturges (1959) have classified reinforcers into five basic types: (1) *consumables* are those reinforcers (rewards) which are either edible or drinkable; (2) *manipulatables* which refer to toys, trinkets, and other small items; (3) *visual and auditory stimuli* such as film strips and movies; (4) *social stimuli* including praise, hugging, and attention; and (5) *conditioned reinforcers* which refer to anything which has acquired a reinforcing property through repeated association with a primary or unconditioned reinforcer. These may also be termed generalized reinforcers. Reinforcers and procedures found useful with children in operant research have been discussed in detail by Bijou and Baer (1966).

Negative reinforcement. A stimulus is called a negative reinforcer if its termination reinforces behavior. This technique is also useful in increasing the frequency of a behavior. For example, the use of aversive or noxious stimuli such as shock or restraint which the subject tries to avoid may serve as negative reinforcement (Nawas & Braun, 1970).

Neutral stimuli. These are other stimuli which originally are not reinforcing, or are neutral with respect to their effect upon the strength of behavior. However, they can become secondary reinforcers by being present when a reinforcing stimulus occurs (Staats, 1964).

Punishers (aversive stimuli). A punisher is an aversive stimulus which follows a response and frequently serves to suppress it. It is important to distinguish between negative reinforcers and punishers. Negative reinforcers precede the response and force its occurrence in order to terminate the unpleasant condition (e.g., a wife's nagging). Punishers, on the other hand, follow the response and decrease the liklihood that the response will be made again (e.g., a slap). The use of punishers in modifying behavior has been widely debated among researchers (Gardner, 1969).

Time and scheduling of reinforcement. The immediacy with which the reinforcement follows a response is crucial (Baumeister, 1967). In strengthening behavior, the effect of a reinforcer is on the immediately preceding behavior; therefore, a reinforcer must immediately follow the response to be learned. A close temporal

relationship between a reinforcer and the behavior to be reinforced is essential for the occurrence of learning (Taber, Glaser & Schaefer, 1965).

The schedule of presenting reinforcement is also important. In general, a given schedule has an effect upon the rate at which a response is emitted (Skinner, 1968). After a response has been reinforced many times, it is possible to maintain the response at some strength by reinforcing it only a portion of the times it is emitted (Staats, 1964). The schedule with which the reward follows the response has a great deal to do with how rapidly the response frequency develops and how long it can be maintained without reinforcement (Baumeister, 1967).

Successive approximation. A response can be *shaped* by first rewarding gross approximations to the final response and then gradually reinforcing only the better approximations to the desired response. Holland and Skinner (1961) state that there are two aspects to shaping skillful behavior: (a) reinforcing only certain responses, which is called differential reinforcement, and (b) gradually raising the requirement for reinforcement, which is called successive approximation. By requiring a slightly improved response each time, behavior is gradually shaped through successive approximation. When successive approximations to a final form of behavior are differentially reinforced, the procedure is called shaping. Shaping is an extremely important concept in operant conditioning.

Crosson (1969) has suggested that most behavior becomes part of a subject's repertoire through the technique of reinforcing

successive approximations of a new behavior or skill. Shaping requires the careful adjustment of response requirements at each level of approximation to the terminal behavior in order to insure adequate levels of positive reinforcement to the subject. This can be best achieved by breaking the material to be learned down into small steps so that the frequency of reinforcement is raised to a maximum and aversive consequences are reduced to a minimum (Skinner, 1968).

Homme et al. (1968) emphasize that behavioral engineering is not simply a matter of contingency management (providing appropriate reinforcement). It is a combination of two technologies: the technology of contingency management and the technology of stimulus control. The technology of stimulus control involves techniques for arranging circumstances so that the response is made while the subject is observing the appropriate properties of the stimulus which is to contol the response.

Stimulus control. When an individual responds in a certain way to a given stimulus, that stimulus can be considered to control behavior. The concept of stimulus control is very important with respect to language and verbal behavior. Skinner (1957) has stated that simulus control which occurs through the operation of discriminative stimuli is basic and highly important to the behavioral process generally referred to as learning. He defines language and communication as verbal behaviors under the control of many kinds of stimuli.

Stimulus control is closely related to discrimination training. In fact, a basic example of stimulus control is discrimination learning.

In discussing stimulus control, Taber, Glaser and Schaefer (1965) say:

> That particular stimuli should come to call out particular responses is an assumption of nearly all training procedures. In the sense that the learner, in order to respond, must be able to distinguish such a stimulus from the general environmental background, it may be said a control stimulus is a discriminative stimulus, one which the learner must learn to discriminate from other stimuli. The process by which subject matter or environmental stimuli in general are brought to control behavior is typically called "discrimination training" (p. 36).

Further elaboration concerning the significance of stimulus control is provided by Crosson (1969). He points out that it is necessary that behaviors be matched to, and functionally integrated with, the requirements of the environment. This process of adaptation is largely a function of behavior coming under the control of certain classes of environmental stimuli. Many behaviors come to be controlled by certain environmental stimuli which serve, in effect, as cues that a behavioral event will be consequated in a certain way. These controlling events, if discrete, are termed discriminative stimuli. Stimulus control exists to the extent that the presence or absence of a stimulus controls the probability of a response (Homme, Baca, Cottingham & Homme, 1968).

Staats and Staats (1964) note that many children who are classified as *exceptional* often exhibit gross discrimination failures of some type. They suggest that many behaviors which we classify as *abnormal* may be a function of defective stimulus control. A similar view is presented by Homme et al. (1968); they point out that most behavioral engineering problems are problems of faulty stimulus control: the subject has the response in his repertoire but it

is not made when the stimulus is presented.

Extinction. Another major principle relates to the process of extinction. A response which has been strengthened by reinforcement will weaken if it is no longer followed by reinforcement. In discussing extinction, Crosson (1969) states that:

> Extinction refers to a behavior-environment relationship. A behavior previously controlled by a positive reinforcer is said to extinguish when such a behavior is consistently followed by neutral or non-reinforcement stimuli. The typical result of this process is a temporary increase in the rate, followed by a gradual reduction of rate to the zero or near zero level (p. 10).

In the process of extinction, reinforcement is witheld with a corresponding drop in response likelihood. In contrast, when a response is punished, an aversive consequence is produced by the undesirable behavior. A combination of positive reinforcement and extinction is generally preferred to punishment in attempts designed to eliminate undesirable behaviors (Baumeister, 1967). The general procedure used by most investigators to eliminate undesirable behavior has been to provide reinforcement for some incompatible or more adaptive behavior while simultaneously ignoring or extinguishing the maladaptive behavior in question (Nawas & Braun, 1970).

Discrimination and generalization. Generalization and discrimination are viewed as reciprocal processes (Holland & Skinner, 1961). A stimulus present when a response is emitted and reinforced becomes a discriminative stimulus. In the future, the response is

more likely to be emitted when this stimulus is present. Other stimuli having something in common with the discriminative stimulus are also effective, but produce a lower response frequency. The spread of controlling power to other stimuli is termed stimulus generalization (Holland & Skinner, 1961).

The principle of stimulus discrimination describes how a stimulus comes to control a particular response. When a response is reinforced in the presence of a certain stimulus and is not reinforced in the absence of the stimulus, that response will come to occur only in the presence of the stimulus. In other words, when the stimulus is presented, the response occurs and when the stimulus is withdrawn, the response does not occur (Staats, 1964).

Application of Operant Principles

Reese (1966, p. 49) has formulated a behavioral model for learning which summarizes and incorporates the major operant techniques which have been found to be effective in changing behavior in a positive way.

A Behavioral Model for Learning

1. Specify the Final Performance (Terminal Behavior)
   a. Identify the Behavior
   b. Determine How It is to be Measured
2. Determine the Operant Level or Current Baseline
3. Structure a Favorable Situation
   a. Provide Discriminative Stimuli for Appropriate Behavior

b. Remove Discriminative Stimuli or Opportunity for Incompatible Behavior

4. Establish Motivation
   a. Locate Reinforcers
   b. Deprive (If Necessary)
   c. Locate and Withhold Reinforcers for Incompatible Behavior
5. Adaptation
   a. Extinguish Emotional Respondents
   b. Provide or Establish Discriminative Stimuli
   c. Establish Reinforcer
6. Shape the Desired Behavior
   a. Reinforce Successive Approximations of the Final Performance
   b. Raise the Criterion for Reinforcement Gradually.
   c. Present Reinforcement Immediately, Contingent Upon the Behavior
7. Utilize Stimulus Control: Fading
8. Reinforce Intermittently
9. Keep Continuous Objective Records

The first step in behavior modification is to specify precisely what behavior is to be established and how it is to be measured. The goal of training should be specified in observable and easily communicable terms (Nawas & Braun, 1970). Specifying the terminal behavior (goal of training) tells precisely where the training is going and what the trainee will be doing to demonstrate that the goal has been reached. Baumeister (1967) notes that the desired response must be potentially available. A profoundly deaf person, for instance, would probably never learn to respond appropriately to a dinner bell or a fire alarm.

The second step involves measuring the current baseline or determining where training should begin. At this stage attempts are made to determine the current or beginning skills of the trainee. A pretest, for example, might serve this purpose.

The third step requires that attempts be made to structure a favorable situation for training. Reese (1966) defines a favorable

situation as one which makes it likely that the desired behavior will occur and unlikely that competing behavior will occur. This involves spotting needs for environmental change such as modifying the physical structure of the environment to make the task easier to learn. For example, the use of special apparatus, or the use of a special area for training where distractions are minimal might be necessary.

The fourth step requires that motivation be established by locating an adequate reinforcer. This usually requires careful observation to determine and identify a set of reinforcers that are effective for the child. If food is utilized as a reinforcer, its value to the trainee can usually be increased if training follows a period of deprivation.

Once potential reinforcers are located, they should be made contingent upon the desired behavior and withheld following undesirable behavior. Reese also suggests that a period of adaptation should precede any attempts at behavior modification. This would ideally involve a period during which the tutor could become acquainted with, and familiar to, the trainee.

Step six is a crucial one for behavior modification programs. Reinforcement should be provided immediately, contingent upon successive approximations of the final performance. The criterion for reinforcement is then raised gradually as training progresses. In establishing a behavior, the reinforcement should be administered on each occasion of the response. Then, as learning progresses, reinforcement should be delivered on an intermittent basis (Baumeister, 1967). It is also

desirable to reward frequently with small amounts. Frequent small reinforcements are more effective than a few large ones. Also, it is important to reward the performance immediately after it occurs and this sequence should occur dozens of times each session (Homme et al., 1969).

The seventh step is especially important in programs designed to facilitate discrimination learning. The procedure is designed to utilize stimulus control by slowly fading (reducing) cues so that discriminations can be formed with a minimum of error responses occuring.

Once behavior is condititioned, it is usually maintained on an intermittent schedule of reinforcement. This procedure usually produces behavior that is more resistant to extinction than behavior which has been reinforced continuously.

The final and essential step, recommended by Reese, is the keeping of continuous objective records. The effects of any procedures designed to modify behavior can be assessed only when objective records are kept. Baer, Wolf and Risley (1968) have suggested that analytic behavior application is a self-examining, self-evaluating, discovery-oriented research procedure for studying behavior. Careful record keeping is an integral part of successful behavior modification programs.

Delimitation of the Study

Importance of the Study

The mongoloid child has long been a neglected member of our society. The reasons for this past neglect are numerous and complex. These children generally do not respond to traditional instructional attempts. The majority of prior attempts at instruction have usually resulted in either slow rates of learning and/or high rates of deviant and nonadaptive behavior. Of particular significance, is the wide acceptance of the view that failure of the mongoloid child to learn is the direct result of physiological and organic defects. It would appear that this assumption requires re-evaluation in the light of more recent research evidence.

There has been a rapid expansion of research in behavior modification in the past two decades. Out of such research has come a number of principles that may be used to explain, predict, and control behavior. The rapidly growing body of research in the development of effective learning procedures which is being produced through experiments in operant conditioning, programmed instruction, and computerized education suggest that, for the first time, it may be possible to develop a true technology of education. Curricula which integrate programmed instruction and contingency management may be able to provide the environments necessary for maximizing learning efficiency. It seems appropriate then, that wherever possible, investigations should be conducted to re-examine the mongoloid child's apparent inability to profit from instruction.

It is generally agreed that adequate language and communication

skills are basic to the acquisition of more complex adaptive behavior pertaining to learning, social, and vocational settings. There is also some evidence to suggest that language comprehension or reception may be prerequisite to language expression or speech (Guess, 1969). Language reception then, is one aspect of communication to which it appears that language intervention programs might be profitably directed. Reviews of the literature however, reveal few investigations which are designed to explore this possibility.

The Scope of the Study

Population used. In view of the fact that the preschool years are generally considered to be very important to development in general and to language development in particular, it was decided that the investigation should involve a sample of relatively young mongoloid children. Moreover, from both theoretical and practical considerations, it seemed appropriate to select non-institutionalized, community-based mongoloid children as subjects.

The sample studied in this investigation was selected from the population of mongoloid children presently enrolled in the beginning sense level program at the Winnifred Stewart School in Edmonton.

Limitations of the study. The applied nature of this investigation resulted in a consequent loss of laboratory precision in several respects. The length of training sessions, nature and extent of reinforcement provided, parental cooperation in creating a mild state of deprivation, and the use of two different tutors, were all important, but difficult to control, variables which contributed to

between subject variation. However, it was felt that a great deal of knowledge could be gained in a practical and more natural situation where the investigator attempted to modify behavior through the application of established learning principles. In the present study the rationale was that the full status of a science is achieved when it aids in the solution of practical problems. The application of learning principles and methods to practical problems would appear to be an important way of advancing the science of behavior (Staats, 1964, p. 125).

Another limitation in the investigation was the lack of available and adequate materials for training purposes. However, since the major purpose of the investigation was the development and evaluation of procedures to facilitate learning, it would seem that any material suited to the level of experiences of the learner would serve adequately as material in an investigation such as this. The pictures from the plates of the PPVT appeared to fulfil this requirement.

The investigator also had difficulty in locating suitable materials to test for generalization effects. Consequently, only limited conclusions can be reached with respect to transfer of training.

Definition of Terms

For the purpose of this study:

Retardation refers to the status of children who emit retarded behavior.

Low-functioning refers to the behavior of children who function at retarded levels, under average circumstances.

Receptive vocabulary refers to the number of pictured objects which the subject can correctly point to when named by the tutor.

Discrimination criterion refers to ten consecutive correct responses to a sequence of stimuli and as a measure to define and quantify the acquisition of four new stimuli.

Trial is defined as a single presentation of the stimuli to be learned.

Correct response refers to the subject pointing to the appropriate stimulus within a ten-second period after being asked to do so.

Incorrect response refers to failure of the subject to point to the appropriate stimulus, or a failure to respond within ten seconds.

Statement of the Problem

The principal purpose of the present investigation was to devise and to evaluate the effectiveness of an integration of programmed instruction and operant conditioning techniques in developing receptive vocabulary in young, non-institutionalized, mongoloid children.

The effectiveness of the procedures was assessed in terms of: (1) the attending behavior during training; (2) the level of correct responding during training; (3) the extent of learning which occurred, and, (4) the amount of material retained following acquisition.

In addition, during the course of the investigation, an experimental probe was conducted to assess the effects of removing the primary reinforcement over a specified period of training. Some attempt was also made to identify generalization effects related to training.

Chapter 3

Related Studies

In this chapter, an attempt is made to summarize briefly the existing research on topics closely related to this study. The topics discussed include: programmed instruction, language acquisition, discrimination learning, retention, transfer and generalization, and learning set. It is felt that a review of this nature is relevant to the interpretation of the results of the present investigation.

Programmed Instruction

There is no generally accepted definition of programmed instruction. Malpass (1970) has defined programmed instruction as follows: "In a general sense, programmed instruction refers to any method of individualized instruction in which the learner progresses through a predetermined sequence of learning materials at his own rate of speed (p. 213)."

Skinner (1961) has stated that what is involved in programmed instruction is the arrangement of a series of very small steps through which the learner can be led into the acquisition of complex forms of behavior. Haring and Lovitt (1967) have suggested that programmed instruction refers to the presentation of progressively more difficult stimulus items or sets of instructional sequences in an environment controlled for contingency management. A similar definition of programming is given by Bijou and Baer (1967):

> Programming refers to the sequences in which stimuli are presented. If the sequences are properly designed, they can bring about the rapid development of a new behavior, a desirable skill, or the loss of an undesirable or hindering behavior. To understand development, it is essential to understand what the programming of experiences can accomplish (p. 95).

Implicit in the foregoing definitions is the notion that simplification may be effected along the stimulus or response dimensions. Both are important.

Malpass (1967) has remarked that Skinner's concepts of programmed instruction have served in large part as models for efforts in this area. Skinner (1961) has been a strong advocate of programmed instruction:

> Until the potentialities of these methods have been investigated, it is meaningless to say that a given organism cannot acquire a given form of behavior . . . In particular, no one knows what the human organism is capable of because no one has yet constructed the environment that will push human achievement to its limits (p. 6).

Programmed instruction techniques have not seen wide application in education as yet. Skinner (1961) has suggested that scarcely any area of human activity has been more resistant to technological change than education. He argues that recent advances in the experimental analysis of behavior have now made it possible to develop a true technology of education. Skinner has not been without support in this claim. For example, Cogen (1969) states: "If educators continue to dally, industry will accept the challenge, or more explicitly, education will be taken out of the hands of the educators (p. 39)." Following a review of the rapidly growing body of research in the development of effective learning procedures which is being produced through experimentation in operant conditioning, programmed instruction,

and computerized education, Johnson (1968) maintained that curricula which integrate programmed instruction and contingency management can provide the environments necessary for maximizing learning efficiency. Johnson's conclusions are especially relevant when the problems of low-functioning children are considered because this group generally do not respond to the traditional approaches used in education.

Some research has already been done where programmed instruction has been tried with children classified as educable mentally retarded (EMR). Malpass (1967) has reviewed several investigations in this area and concluded that the research results leave little doubt that EMR level children can acquire and retain basic academic skills when adequate programming is employed. A somewhat less optimistic picture has been presented by Green (1966). Following his review, Green stated: "To date, the research carried out in the area of programmed instruction with the retarded is not extensive and in many cases the studies lack methodological sophistication (p. 209)." However, Green's criticisms were not directed at programmed instruction, per se.

Green (1966) identified three principal types of studies in his review: (1) investigations of program variables; (2) studies concerned with program evaluation or development; and, (3) studies comparing one form of programmed instruction with another form, or comparing programmed instruction with conventional teaching procedures. Both Green and Malpass noted that studies of the latter type are decreasing in frequency.

The major controversy in investigations of program variables has centered on the relative merits of prompting (preventing the subject from making errors) versus confirmation (the subject first responds and then is given confirmation). Prompting is thought of as maximizing guidance and the confirmation sequence as minimizing guidance. Several investigators (Denny, 1966; Green, 1966; Skinner, 1968) have indicated support for the prompting procedure--especially in programs designed for mentally retarded populations.

Concomitant with the development of programs is the problem of program implementation or presentation. Skinner (1968) has been a strong advocate of automated or semiautomated presentation of materials. However, machine presentation of programmed materials would appear to have serious limitations when used with low-functioning populations such as young mongoloid children. Denny (1966), for example, has noted that the utility of teaching machines appears to be based on three assumptions that: (1) the subject is reinforced for being right; (2) the subject is reinforced by moving ahead in the program; and (3) the subject is attending to the task. Denny (1966) has suggested that the validity of these assumptions may be questioned when programmed instructional efforts are directed at low-functioning children. These children may not respond to the reinforcers provided by machine presentation of programmed materials, and, consequently, innovative procedures are necessary. One alternative procedure might involve the use of external reinforcers dispensed by a teacher or tutor (i.e., programmed tutoring).

Language Acquisition

Much of the literature on language acquisition has emphasized the production of language. However, Goda (1969) emphasized that the level of speech comprehension (receptive language) can be equally as important as the level of the child's speech production (expressive language) in a language stimulation program.

The analysis of language provided by Skinner (1957) shows that the complex structure of verbal behavior may be considered in terms of a series of component segments including: (1) echoic behavior, (2) auditory control, (3) tacting, (4) manding, and (5) intraverbal sequences. Bricker and Bricker (1970) have pointed out that this component content approach has made more explicit the means for moving language behavior from a simple to a more sophisticated level.

Several investigators (Baer, Peterson & Sherman, 1968; Bijou & Sloan, 1966; Kerr, Meyerson & Michael, 1965; Lovass, 1968; Risley, 1966; Risley & Wolf, 1968; Sloan & MacAulay, 1968) have adopted Skinner's component-content model in the study and development of expressive language behavior. They have been able to present rather impressive evidence that low-functioning children can benefit from language training if instructional efforts are highly structured and used simultaneously with appropriate reinforcement techniques.

Only a few attempts designed to enhance the receptive aspects of language have been reported to date (Bricker, 1967; Bricker & Bricker, 1970; Denny, 1966; Guess, 1969; Guess, Rutherford, Smith & Ensminger, 1970).

Denny (1966) has described in detail a program designed to establish better verbal control of the severely retarded child's behavior in a wide variety of situations. While some mongoloids were involved in the program, the subjects were all over ten years old. Denny has designed an ingenious apparatus (MUDRAFA) which enables the trainee to respond nonverbally to a wide variety of commands. In general, the procedures used in the program involved: (a) the use of special devices; and (b) the systematic application of learning principles.

A language development program involving the use of non-professionals in language programs with severely retarded children is presently being conducted in the Ranier State Institution for the Mentally Retarded (Guess, Rutherford, Smith & Ensminger, 1970). The training procedure requires that the children first receptively identify the words, usually represented by pictures, and then name the words. Two of the major limiting factors reported by the investigators were the lack of suitable materials and the lack of adequate instruments to evaluate progress. They emphasize that planning effective language programs for severely retarded children is not an easy endeavor. They found it necessary to confine their program to a delimited number of deficit areas, and then plan systematic lessons aimed specifically at these areas.

Another recent language study has been reported by Bricker and Bricker (1970). These investigators have suggested that since the articulatory movements involved in word production are complex, the acquisition of word meaning in low-functioning children might be

initiated more appropriately if it were *independent* of word production. This line of reasoning would appear to be particularly appropriate for the young mongoloid child, since this population generally experiences unusual difficulty in producing intelligible speech. Bricker and Bricker (1970) have suggested that pointing to a named object, or following a command, are both examples of appropriate responses to a verbal stimulus which are generally less complex than emitting an appropriate verbal label.

In an earlier study, Bricker (1967) followed this approach with autistic children by making reinforcement contingent on appropriate object selection and using a verbal label to indicate the appropriate stimulus for choice. More recently, Bricker and Bricker (1970) have reported on a similar study involving young, institutionalized, severely retarded children. In this study, two different procedures for facilitating the development of word control over object choice were compared. A two-choice discrimination paradigm was utilized in which object name indicated the reinforced response. The design assessed the effects of structured versus unstructured procedures in facilitating the development of this skill. The results indicated training effects in favor of the structured approach. Generalization effects related to training were also identified.

In summary, while language behavior is very complex, there appears to be evidence in support of drawing a distinction between receptive and expressive language behavior. There is also some evidence to indicate that the language deficit of low-functioning children might be approached by programs designed to increase appropriate

responding to verbal stimuli if instructional efforts are structured (programmed) and linked with appropriate reinforcement procedures.

Appropriate responding may take the form of a verbal or a non-verbal response. In some instances, a non-verbal response would appear to be less complex, and consequently, the acquisition of word meaning might be initiated more appropriately if a non-verbal response were required initially in language training programs.

Discrimination Learning

After reviewing the literature on discrimination learning up to about 1966, Baumeister (1967) noted that, of all the sub-areas of learning that have been studied in relation to mental retardation, none has been so thoroughly investigated as discrimination learning.

The impetus for this research has been provided by several factors. The ability to make one response instead of another (response differentiation) or to respond to one stimulus instead of another (stimulus differentiation) in the appropriate environmental contexts is very important. Barrett and Lindsley (1965) have suggested that both response differentiation and stimulus differentiation are basic component behaviors demanded by more complex tasks.

Several reviews of the literature dealing with discrimination learning among mentally retarded subjects have been published (Baumeister, 1967; Scott, 1966; Stevenson, 1963). Following a review of the literature on discrimination learning, Stevenson (1963) concluded that only a few questions can be answered with surety. The data reviewed suggested that retarded subjects can learn discrimination problems but duller subjects have more difficulty than brighter

subjects in solving problems. He also found that the mentally retarded show evidence of developing learning set and that conditions can be arranged so that learning is facilitated.

Research in the area of discrimination learning has been given added impetus by the theoretical work of Zeaman and House (1963). In their attentional model of discrimination learning, Zeaman and House posit a chain of two fundamental processes underlying discrimination learning, namely: (1) observing the various stimulus dimensions, and (2) making the instrumental response. The probability of making the correct observing response is a function of various factors and their interactions. Zeaman and House (1963) suggest that the basic problem for the retardate is a low initial probability of attending to relevant dimensions. They present rather impressive evidence (1958, 1960, 1963) to support this *attention deficit* theory. Another investigator (Denny, 1966), has also speculated that one of the basic deficits of the mentally retarded involves the duration of attention. Denny has suggested that the mentally retarded child seems to be at the beck and call of each and every stimulus change.

A further review of the research in discrimination learning among retardates has been conducted by Baumeister (1967). Baumeister presented a number of conclusions regarding factors that have been found to influence discrimination learning. In general, procedures that lead to increased distinctiveness of the stimuli to be discriminated can enhance the rate of acquisition. This distinctiveness can either be in the stimuli themselves, or, can be acquired through the use of special training techniques. Baumeister also noted that previous

experience in discrimination learning situations is an important factor related to the rate of learning (i.e., learning set).

The role of verbal mediation in discrimination learning has been widely debated (Shepp & Turrisi, 1966; Wolff, 1969). There is general agreement that verbal mediation facilitates discrimination learning in older subjects. However, the role of verbal mediation in younger children is still unclear. Wolff (1969), for example, has found that while appropriate verbalization was helpful to nursery school subjects in learning simple discriminations, far more potent sources of stimulation can influence the child's discrimination learning than are provided by his own linguistic behavior.

Scott (1966), after reviewing the basic research on discrimination learning with retarded children, concluded that once they attend to the relevant aspects of a problem, they learn at the same rate as normals. Scott indicated that the two major variables that control attention are reinforcement and the nature of the stimulus display.

The role of reinforcement in discrimination learning has been emphasized by Skinner (1968). Skinner contends that by arranging appropriate contingencies of reinforcement, specific forms of behavior can be set up and brought under the control of specific classes of stimuli. The importance of differential reinforcement in discrimination learning has been stressed by several investigators (Barrett & Lindsley, 1965; Bijou & Baer, 1967; Massey & Insalaco, 1969; Taber & Glaser, 1964). Taber and Glaser (1964), for example, have stated the following:

> The application of the discrimination training paradigm to human learning programs rests on simple assumptions and

> permits a clear specification of the procedures to be followed. In bringing about discriminative control, it is simply required that the desired response be elicited in the presence of the stimulus which is to acquire discriminative properties, and that reinforcement be contingent upon such an occurrence. It must be assumed at the beginning of discrimination training that the response over which control is sought exists to some strength in the repertoire of the organism (p. 201).

Another important factor in discrimination training is error response. How can a discrimination be taught so that a minimum of errors occurs? An early study by Jeffery (1958) bears on this point. Jeffery analyzed the experiences that could be prerequisite to forming a left-right discrimination in young children who lack this type of differentiated response. Jeffery's study represented a simple example of *programming* in which the sequences in which the stimuli were presented were carefully arranged. Terrace (1963) has also shown that excellent discrimination can be taught quite quickly with no errors, and further, that these errorless discriminations show important *emotional* differences from discriminations developed in the ordinary way. Using an adaptation of Terrace's procedure, Moore and Goldiamond (1964) have reported a study on a visual discrimination task with preschool children. In this study, they too showed how presentations could be programmed to minimize extinction trials (errors).

It would appear that efficient discrimination training requires very precise control of the discriminative stimuli and considerable inventiveness in the arrangement and presentation of stimulus materials. Every effort should be made to avoid erroneous responding (Michael, 1967). The development of erroneous behavior is seen as an indication that the stimulus change has been too rapid.

In summary, the literature reviewed suggests some cautious conclusions with respect to discrimination learning in mentally retarded subjects. *Attending* may be construed as a general name for behavior which produces or clarifies a discriminative stimulus (Holland & Skinner, 1961). The major variables that have been found to control attention are reinforcement and the nature of the stimulus display. There is evidence to suggest that both differential reinforcement and careful arrangement and presentation of stimulus materials are essential to promote efficient discrimination training. With full environmental control, adequate programming techniques, and suitable reinforcing agents, several studies have demonstrated that selected behaviors of retarded children may be rapidly brought under stimulus control.

Retention

To the investigator's knowledge, no studies have systematically investigated retention in mongoloid children. Vergason (1968) has reviewed several studies dealing with retention (memory) in EMR level children. The research reviewed indicated that, under certain conditions, memory is as good as that of normals. He emphasized that "we can only measure performance and then infer learning and memory."

A general finding reported by Vergason was that when materials are meaningful and overlearned, EMR children learn and retain as well as normals. Denny (1964) has noted that there is little available evidence of an appreciable deficit in long-term retention when the mentally retarded are compared with normals, provided that the

two are matched on original learning. This finding was also supported by Skuell and Keppel (1970). Recent evidence (Ellis & Anders, 1968; Haywood & Heal, 1968; Nawas & Braun, 1970) has shown that it is necessary to qualify any statements made about memory deficit in retarded children.

Probably one of the best known variables known to affect retention is the degree of original learning (Underwood, 1964). The real significance of overlearning seems to be summed up in these remarks by Spicker (1966): ". . . acquisition of knowledge depends on the complexity of the task to be learned, while retention of knowledge is determined by the amount of overlearning that takes place (p. 92)."

In summary, it appears that the process involved in acquisition represents the greater impairment for the EMR level child. Associations, once formed, are fairly durable (Baumeister, 1967).

Transfer and Generalization

Transfer of training, broadly speaking, refers to instances where learning in one situation affects, in some way,the individual's performance in another, somewhat different situation.

Considering its obvious importance, transfer of training has received relatively little attention by researchers in mental retardation. Kaufman and Prehm (1966), after examining the available transfer literature, observe that: ". . . investigators in mental retardation have virtually ignored transfer of training as a topic for organized systematic research (p. 137)." They found that the research in this area was extremely diverse and left much to be desired.

"One-shot" studies were common and there was a relative void of research related to pragmatic, applied situations.

Another more recent review of transfer literature (Drew & Espeseth, 1968) has concentrated on those studies dealing with the following important questions: (1) Can low IQ subjects transfer learning from one setting to another? and, (2) What types of learning opportunities increase the probability of transfer? In reference to the former question, the evidence reviewed indicated that an increase in transfer occurred when (a) the retardate was relatively young, (b) a high similarity between tasks existed, and (c) meaningful pretraining of a varied and general nature was provided.

Drew and Espeseth concluded their review with some suggestions as to the types of learning opportunities which have been found to increase the probability of transfer occurring: (1) transfer procedures should be an important consideration in structuring retardates early learning experiences, (2) transfer is best when both the initial learning task and the transfer task are quite similar, (3) both learning and transfer are facilitated if the task is meaningful to the subject, and (4) training that is general and varied in terms of material presented increases the efficiency of transfer.

Another way to view transfer is in terms of stimulus generalization. One basic learning principle states that when a response to a particular stimulus is reinforced, the liklihood is increased that the response will occur to similar stimuli. The tendency of similar, but not identical, stimuli to call forth previously learned behavior is called stimulus generalization (Taber, Glaser, & Schaefer, 1965).

Viewed in this perspective, certain considerations become evident if stimulus generalization is a desirable product of training. For example, if the learning environment is not carefully structured, it is likely that incorrect generalizations will be reinforced. If generalization is the critical goal of training, an instructional program should include appropriate sequences to insure the precision of the resulting discriminations, or the breadth of subsequent generalizations.

In summary, the available literature indicates that transfer of training and stimulus generalization have not been extensively studied with retarded populations. However, learning theory seems to provide some constructive guidelines for the design of programs to promote either stimulus generalization or, conversely, the development of appropriate discriminations.

Learning Set

One of the major problems in educating severely and profoundly retarded children is their apparent inability to derive much benefit from past experience. Some investigators have speculated that a *qualitative* difference exists causing such failures. For example, Girardeau (1959) has reported that mongoloid retardates are significantly inferior in their abilities to form learning sets when matched on MA to normals. In explaining his findings, Girardeau postulated that the structures of abilities for the two groups are made of different factors.

The ability to benefit from past experience is essential in situations requiring discriminations and has been investigated under

the heading of discrimination learning set. This work was stimulated by Harlow (1949), who found that when successive discrimination problems of a similar kind were presented to monkeys, each problem tended to be learned somewhat more readily than the preceeding problem until, finally, the problems were learned in a minimum number of trials (i.e., one trial).

There is some evidence to indicate that low-functioning children do develop learning set (Baumeister, 1967; Bricker, Hear, Bricker, Hayes & Larsen, 1969; Harter, 1965; Kaufman & Prehm, 1966; Stevenson, 1963). After reviewing the majority of available studies on learning set, Stevenson (1960) concluded that retarded subjects show some evidence of developing learning set. Baumeister (1967) has also found evidence indicating that previous experience in discrimination learning situations is an important factor related to rate of learning. The more practice a subject has on similar problems, the more rapidly he solves subsequent ones.

Harter (1965) has reported that rate of discrimination learning set formation is related to both MA and IQ. Learning set performance improves with MA to an upper limit of 8 or 9 years old and to an IQ of 100.

Zeaman and House (1962) have suggested that another factor related to the development of learning set is the nature of previous experience. Prolonged failure experiences apparently create an inability to solve problems (failure set).

In summary, discrimination learning set has been a major area of research in mental retardation. The child who does benefit from the consequences of previous choice can be taught to respond

to objects and object properties such as color, size, number, or position by suitable arrangement of the discriminanda and the reinforcers. Investigators have only recently begun to explore the various means by which such behavior could be trained (Bricker et al., 1969; Terrace, 1963; Touchette, 1968). These training procedures have been used to establish discriminative behavior in both two-choice and multiple-choice situations, even with profoundly retarded persons. For example, the Bricker et al. (1969) study has indicated that even severely subnormal children were capable of developing more appropriate problem-solving behavior under facilitory training procedures.

The foregoing summary of research findings on programmed instruction, linked to reinforcement, discrimination and generalization, retention of learning, learning set, and the acquisition of language, would appear relevant to the present study on devising materials and equipment for, and applying techniques to, the problem of developing receptive language in young mongoloid children. A description of the design which was adopted to investigate the problem follows in Chapter 4.

Chapter 4

Design of the Experiment

Subjects

The sample consisted of ten subjects drawn from the population of children with Down's syndrome (mongolism) presently attending the Winnifred Stewart School for home-dwelling trainable level children in Edmonton. Since all the subjects were enrolled in the beginning "sense training" program (Stewart, 1959) at the school, it was assumed that the children selected for the experiment were receiving reasonably similar experiences in the regular classrooms.

On the basis of a multidisciplinary assessment by the local diagnostic team at the Glenrose School Hospital, several of the mongoloid children at the beginning level of the school program were excluded due to reported auditory and visual problems.

In the main, the children could be described as nonverbal. Their attempts at vocalization were limited and mostly unintelligible. Mastery of receptive speech ranged from an apparent understanding of relatively few words to a receptive comprehension of approximately fifty to one hundred different words.

Observation of the children over an extensive baseline period revealed a number of characteristic behaviors. The children were generally active and friendly, but tended to move from activity to activity at a high rate. When requested to attend, to remain seated, or to approach the teacher, they often ignored the request or failed to comply. Deviant behaviors, including attempts to

escape, hitting, grabbing, dropping, throwing, and banging objects were frequently evident.

The sample fell within Heber's (1959) medical classification VI, with confirmed diagnosis of Down's syndrome. In general, they met the usual behavioral criteria for categorization as severely mentally retarded.

The subjects were equated in pairs, as closely as possible, on the variables of sex, IQ, MA, and language age (LA). Subjects in each pair were assigned by chance to the experimental or comparison group. Table 1 presents a description of the experimental subjects in terms of CA, MA, LA, and Social Competency. Table 2 presents comparative data for the comparison group.

Instruments

The following instruments were used in this study to provide: (1) descriptive data, and, (2) an empirical basis for the formation of two matching groups.

Stanford-Binet Form L-M. The Stanford-Binet purports to measure the general intellectual level of the individual. It is the best known and most widely used test of individual intelligence. Compared with most of the other major intelligence tests currently available, the Stanford-Binet is especially useful with low-functioning children. The Binet consists of a series of tests arranged by age levels, and covers a wide age range. It is suitable for most children from the preschool years through adolescence. The tests begin at the two-year old level and continue on up to the superior adult level.

TABLE 1

CA, IQ, MA, LA, and Social Competency of Subjects

in the Experimental Group

		Measure					
		SB-LM		PPVT		Mecham	Cain-Levine
Subject	CA (mos)	IQ	MA	IQ	MA	LA	%ile
Alan	81	32	30	10	26	1.28	16
Dennise	52	54	29	29	25	1.83	50
Douglas	73	30	27	21	29	2.28	28
Kevin	72	35	30	10	24	1.78	8
Laurie	81	42	38	11	27	2.89	76
MEAN	72	39	31	16	26	2.01	39
SD	11	9	4	8	2	0.54	25

TABLE 2

CA, IQ, MA, LA, and Social Competency of Subjects

in the Comparison Group

		Measure					
		SB-LM		PPVT		Mecham	Cain-Levine
Subject	CA (mos)	IQ	MA	IQ	MA	LA	%ile
Cathy	81	42	38	20	29	2.89	55
Collette	66	41	32	21	26	1.61	50
Jimmy	70	37	35	34	36	1.55	39
Marc	89	30	24	10	21	1.39	15
Peter	76	33	30	11	27	3.00	28
MEAN	76	37	32	19	28	2.08	38
SD	8	5	5	9	5	0.70	15

At the lowest age levels, the tests require the child to identify objects, identify parts of the body, identify pictures, obey simple commands and perform simple tasks on verbal request.

The Stanford-Binet is based on the assumption that intelligence is an overall or general intellectual ability which develops with age and is reflected in almost any activity undertaken.

The Peabody Picture Vocabulary Test. According to the manual, the Peabody Picture Vocabulary Test (PPVT) was devised to measure children's comprehension of the spoken word as well as their ability to associate a verbal symbol with its pictorial representation (Dunn & Hottel, 1960).

The PPVT consists of 150 plates, each composed of four pictures arranged in ascending order of difficulty (from one year, nine months, to eighteen years). The illustrations are clear, bold, line drawings, free of fine detail and figure-ground problems. Dunn (1959) suggests that the PPVT is especially suitable for trainable level children who often display low mental ages, short attention spans, and lack of intelligible speech.

The requirements which must be met by the subject are fairly simple: he must be able to hear the word, see the drawing, and produce a simple pointing response. The total number of pictures which the testee is able to point to,when given the verbal stimulus, is taken as a measure of receptive vocabulary.

The PPVT has two forms which differ only in that they use different words. A standardization population of 4012 children was employed. Test-retest and equivalent form reliabilities have

both proved to be satisfactorily high in most studies with retarded children (Budoff & Purseglove, 1963; Dunn & Hottel, 1961). Correlations of the PPVT with Stanford-Binet MAs have a median of 0.83. However, retarded subjects whose PPVT scores were unreliable show somewhat lower correlations with Stanford-Binet IQs. Research with trainable children (Dunn & Hottel, 1960; Budoff & Purseglove, 1963; Hamill & Irwin, 1965) has produced coefficients ranging between 0.52 and 0.66.

A number of studies have shown that for children below four or five years, PPVT MAs tend to be significantly lower than MAs on the Stanford-Binet (Budoff & Purseglove, 1963; Mein, 1962; Tobias & Gorelick, 1961). In summary, while it would appear that standardization of the scale is somewhat limited at the lower levels, the PPVT does provide a fairly reasonable basis for matching subjects in terms of receptive language age.

Mecham Verbal Language Development Scale. This scale is an extension of the communication portion of the Vineland Social Maturity Scale. The method of administration is the informant interview method. The informant may be anyone who knows the child intimately, preferably the parents or the teacher. During administration, the examiner describes certain behaviors, and, based on the informant's responses, classifies the behavior as: (1) routinely or habitually performed by the child, (2) in a transitional or emergent state, or (3) performed only rarely or entirely absent. Scores are derived which may be converted to equivalent language ages. According to the manual, the tentative normative scores were derived from a sample

of 120 normal speaking children, selected randomly from urban and rural areas. This sample included five boys and five girls on each of the twelve age levels on the scale. Little has been published concerning its reliability or validity, but it has the virtue of utilizing an interview procedure with an informant who is well-acquainted with the child's language behavior in familiar settings.

Cain-Levine Social Competency Scale. The Cain-Levine is a social competency scale devised especially for use with trainable mentally retarded children. It was standardized on 716 mentally retarded children in California, all of whom were living at home. Chronological age of the standardization population ranged between 5 and 13 years, 11 months; the IQs and MAs ranged from 25 to 59 and from 2 through 7 years, respectively.

The Cain-Levine consists of forty-four items, which are divided into four subscales: self-help, initiative, social skills, and communication. Tables are provided to convert each subscale score and the total score to percentile scores in relation to other trainable mentally retarded children. As in the Mecham, the method of administration is the informant interview technique. Test-retest reliability is reported in the manual to range between .88 and .98. The validity data are based on the opinions of expert judges as to the usefulness of the items and their alternatives as "describers" of the specific item in the realm of social competency.

Other Evaluative Procedures

Pre- and posttests. The pretest was based on all pictures of the PPVT up to a ceiling of 10 failures in any 12 consecutive items. Any items above this ceiling were assumed to be failed. During testing, subjects were shown one page at a time and randomly asked to "touch the _____," until all the items (i.e., four) shown on each plate had been tested. Each succeeding plate was then tested in turn until the ceiling was reached. The test was then repeated for a second time and those items on which the subject had at least one correct response in the two trials were tested on a third occasion. Those items responded to correctly on 2 out of 3 trials were scored as correct. The test was administered over a period of several short sessions in order to maintain responsiveness. Both social and primary reinforcement were given on an intermittent basis (non-contingently) throughout the testing to keep the subjects motivated. These innovative procedures were considered necessary in view of the immaturity, short attention spans, and high frequency of random responses emitted by low-functioning children. The post-test was identical to the pretest.

Generalization tests. A series of colored pictures, similar to the objects pictured on the PPVT, were collected to serve as test items for one generalization test (the majority of these were obtained from Whitman flash cards). A second test for generalization effects consisted of black and white pictures similar to the PPVT pictures. (These test items were obtained from Developmental Learning Materials

(DLM) kits.) One of the major limiting factors in testing for generalization effects was the lack of suitable materials. Consequently, it was not possible to obtain matching test items for all of the training stimuli. All those pictures judged suitable for testing for generalization effects were mounted on four x six cardboard cards. Plasticized covering was then applied to each card.

Tutors

The tutorial staff consisted of a qualified nursery school teacher, with formal preparation and practical experience in teaching low-functioning children, and two teacher aides. The teacher and one teacher aide were responsible for conducting the training sessions.

The tutors were familiar with, and practiced in, the application of operant conditioning principles (Cameron & Crozier, 1970). Prior to beginning the experiment, several instructional training sessions were conducted utilizing children from the school not involved in the investigation in order to standardize training and data collection procedures. Prior to beginning the training, the experimental group was divided so that each tutor was responsible for the same subjects throughout the experiment.

The Training Program

The training program might be termed "programmed tutoring" because learning conditions were individually programmed to provide sequential arrangement of training stimuli and systematic presentation of reinforcing events to optimize each child's performance. A preliminary analysis of pretest performance resulted in a list being

compiled of failed items for each member of the experimental group. That is, those items failed in the pretest provided the basis for selection of training stimuli for each experimental subject. Thus, in a general sense, instruction was programmed since each learner progressed through a predetermined sequence of increasingly more difficult learning materials (Malpass, 1967).

Terminal behavior was defined as correctly pointing to a named picture when it was displayed in a group with three others. New pictures to be learned were taught in groups of four. A series of small steps (successive approximations) as shown in Table 3, were designed in order to keep the number of error responses at a minimum. In step one, each picture was displayed singly until a criterion of five consecutive correct responses was attained. In step two the pictures were displayed in pairs until all possible pairs (i.e., six) were presented. The subjects were required to produce five consecutive correct responses for each pair of stimuli displayed. In step three, the pictures were displayed in groups of three. There were four possible groupings of three among the four pictures, and the subjects were required to produce five consecutive correct responses for each triplet of pictures displayed. In step four, all four pictures were displayed simultaneously, until a criterion of ten consecutive correct responses was attained.

In all four steps, the subject was instructed to "touch the _____" for each trial. The cue stimulus varied in successive trials. A response was scored correct if the subject touched the appropriate picture within a ten-second period. To control for response set (Gerjuoy & Winters, 1969), the pictures were randomly

rearranged following each correct response. Following an incorrect response, the tutor said: "No, this one is the _____," and proceeded to demonstrate the correct response. The request to "touch the _____" was then repeated and following the correct response, the pictures were again randomly rearranged for each succeeding trial until another incorrect response occurred. Reinforcement in the form of small bites of food and praise was programmed following correct responses. Primary reinforcement was gradually reduced to an intermittent basis during the later training sessions, depending upon the responsiveness of the individual subjects.

TABLE 3

Programming for Each Group of Four Pictures Taught

(A, B, C, and D Represent Individual Pictures)

Step	Substep	Stimuli presented	Consecutive correct responses to criterion
I	1	A	5
	2	B	5
	3	C	5
	4	D	5
II	5	AB	5
	6	AC	5
	7	AD	5
	8	BC	5
	9	BD	5
	10	CD	5
III	11	ABC	5
	12	ABD	5
	13	ACD	5
	14	BCD	5
IV	15	ABCD	10

Minimum trials to criterion = 80

In summary, an attempt was made to provide programmed instruction by: (1) arranging material in increasing order of difficulty, (2) presenting materials in a sequence of small steps, (3) requiring an active response for each trial, (4) providing immediate confirmation and reinforcement for correct responses, and (5) adjusting session length depending on the responsiveness of the individual subject.

A minimum of 80 trials was required to *learn* four new pictures; that is, the subject's pointing response could ideally be brought under the stimulus control of one new stimulus on an average of 20 training trials. Finally, the program called for a certain amount of "overlearning" as there is some evidence that this facilitates retention (Spicker, 1966).

Materials and Apparatus

Training location. Training and testing were conducted in a laboratory classroom located in the Winnifred Stewart School. The room contained a cubicle of about 8 x 8 feet, equipped with a viewing window, two chairs and a table.

Apparatus. Two 19" by 24" sturdy display boards equipped with four plastic covered windows each served as a means whereby the training stimuli were presented to the subjects. This apparatus allowed the tutors to rapidly display and rearrange the stimuli.

Recording. A five channel Lafayette Multi-Counter was attached to each display board. This permitted the tutor to tabulate up to five simultaneous events during each training session. These

data were then recorded on summary forms at the end of each training session.

Training stimuli. The pictures from the plates of the PPVT were chosen as training stimuli for the experiment. The primary reason for this decision was the fact that these pictures could be arranged in empirically determined order of difficulty for training purposes. Also, the pictures covered a wide range in terms of difficulty levels. A secondary reason was the nature of the stimuli themselves: the illustrations were clear line drawings, free of fine detail and possible figure-ground confusion. All pictures judged to be suitable for training purposes were mounted on 4" by 6" cardboard cards and plasticized covering was then applied to each card.

Procedure

The procedure may be considered in terms of three phases: (1) pre-training phase, (2) training phase, and (3) post-training phase.

Pre-training phase. During the pre-training phase the subjects were individually tested with the Stanford-Binet, PPVT, and the pretest. Testing was done by an experienced examiner; however, in a few instances, it was necessary to utilize the children's teachers as mediators in an attempt to secure a reliable test score for the subjects. The teachers of the respective children were interviewed as informants for the Cain-Levine and Mecham scales. Following this preliminary testing phase, the sample was randomly divided into

two groups (Tables 1 and 2).

An attempt was made to identify suitable primary reinforcers for each member of the experimental group by securing from the parents a list of consumables which their child liked. The selection of reinforcers to meet the varying individual preferences proved to be an administrative problem. Finally, it was concluded that food supplied by parents to meet each child's preferences would prove most effective. The parents further cooperated by sending their child to school in a mild state of deprivation, induced by a light breakfast, such as a glass of fruit juice and a vitamin pill.

Training phase. The training phase lasted approximately eight weeks. Each child was given one or two 15- to 30-minute sessions of individualized training each day. Training sessions were scheduled either in the morning or the afternoon, at times when the subjects were receptive to food and motivated to "earn" small bites of breakfast or lunch.

One of the basic problems faced by the tutors was the high rate of deviant behavior exhibited during preliminary attempts at training. Behaviors such as hitting, grabbing, inattention, refusal to respond, random or silly responding, and attempting to leave the chair (or room) were frequent. Before any effective training could be conducted, it was necessary to bring these incompatible behaviors under control. A combination of techniques was used to achieve this end. Incorrect or inappropriate responses received no primary or secondary reinforcement from the tutors. Brief periods of "time-out," during which the tutor held her head down and avoided

eye-contact with the subject, were programmed following mildly deviant behavior (inattention, inordinate delays in responding, random or "silly" responses). More disruptive behavior such as leaving the chair, or grabbing at the food rewards or materials resulted in a sharp "No!" paired with a slap on the wrist if necessary. Severe deviancy, such as complete refusal to respond or temper tantrums, was followed by an extended period of time-out: the tutor left the room taking all rewards and materials with her.

During each session, the tutor kept detailed records of correct, incorrect, and total trials to criterion for each step in the program. The actual time spent in training during each session was also recorded and an attempt was made to gradually extend the duration of the training periods. The actual length of the training session was determined by the tutor, who decided at the completion of a step whether or not an attempt should be made to complete another step in the program in that particular session.

An experimental probe was conducted to assess the effects of withdrawing primary reinforcement following approximately 10 sessions of training. Five training sessions were conducted with each subject in the usual manner; however, no primary reinforcement was utilized. Following this period, the primary reinforcement was reintroduced.

Throughout the training, the following series of tests were administered:

(1) *Retention tests.* Retention for each group of four training stimuli was checked on two occasions: (1) the day following acquisition (completion of step four); and (2) seven days following acquisition. The procedure followed to test retention consisted of

the four stimuli being displayed simultaneously with the subject being required to point to each one when named. Two trials were given for each picture making a total of eight trials in the test. The stimuli were randomly rearranged following each trial. An item was considered *retained* if it was responded to appropriately on both trials.

(2) *Generalization test.* A test for generalization effects was administered immediately before, and after, training on each group of four stimuli. That is, four colored pictures, similar to the ones about to be trained, were selected. Immediately prior to, and after, training with the PPVT pictures, the subject was tested using the colored stimuli. The four colored stimuli were displayed simultaneously and the subject was asked to point to each one when it was named. Five trials were given for each of the stimuli, with rearrangement following each trial.

Post-training phase. The post-training phase of the experiment immediately followed the 40 sessions of individualized training. To provide comparative data on the overall progress of the two groups, a posttest identical to the pretest was administered to both groups. The posttest permitted a more realistic appraisal of training effects by controlling for gains which might have resulted from normal classroom experience.

An analysis of posttest performance for members of the experimental group produced a list of items for each subject consisting of items which had been trained *and* scored correct on the posttest. On the basis of this analysis, two further tests for generalization

effects were conducted with each experimental subject. The first test consisted of similar non-colored stimuli and the second, similar colored stimuli. For testing purposes, the test stimuli were displayed in groups of four and a correct response consisted of pointing to the appropriate stimuli when asked to do so. Three trials were given for each item. Stimuli were randomly rearranged after each trial. Credit was given if a correct response occurred on two of the three trials.

An experimental probe to determine the effectiveness of the procedures in maintaining attending behavior was conducted immediately following the training and post-training tests.

Informal observation indicated that the experimental subjects had demonstrated increasingly more task-oriented behavior with consequent decreases in deviant behavior as training had progressed. To obtain empirical evidence for this observation, each subject was given one hour of continuous training and a trained observer recorded the subject's "attending behavior" for successive ten-minute intervals. The number of seconds in each ten-minute interval that the subject was looking either at the tutor or at the display board was taken as a measure of attending behavior. Similar measures were taken on the control group in order to provide a basis for comparing the attending behavior of the two groups.

Chapter 5

Results

The principal purpose of the present study was to devise and to evaluate the effectiveness of an integration of programmed instruction and operant conditioning techniques in developing receptive vocabulary in young, non-institutionalized, mongoloid children.

In this chapter, procedural effectiveness is assessed in terms of: attending behavior, levels of correct and incorrect responding, acquisition, and retention. In addition, data are presented to show the effect of withdrawing primary reinforcement over a period of training. Generalization effects related to training are also investigated.

The graphs, tables, and related discussion in this chapter represent the essential findings of the study.

Attending Behavior

Attending behavior was defined as the time during which the subject was looking either at the tutor or at the display board. In order to determine how effective the training procedures were in maintaining attending behavior, the subjects in both the experimental and comparison groups were each given one hour of continuous training.

The percentage of time the subject was attending over five successive 10-minute intervals was calculated. Figure 1 presents the results of this analysis for subjects in the experimental group.

Three subjects attended over 80% of the time throughout the 50 minutes of observation time. The fourth experimental subject

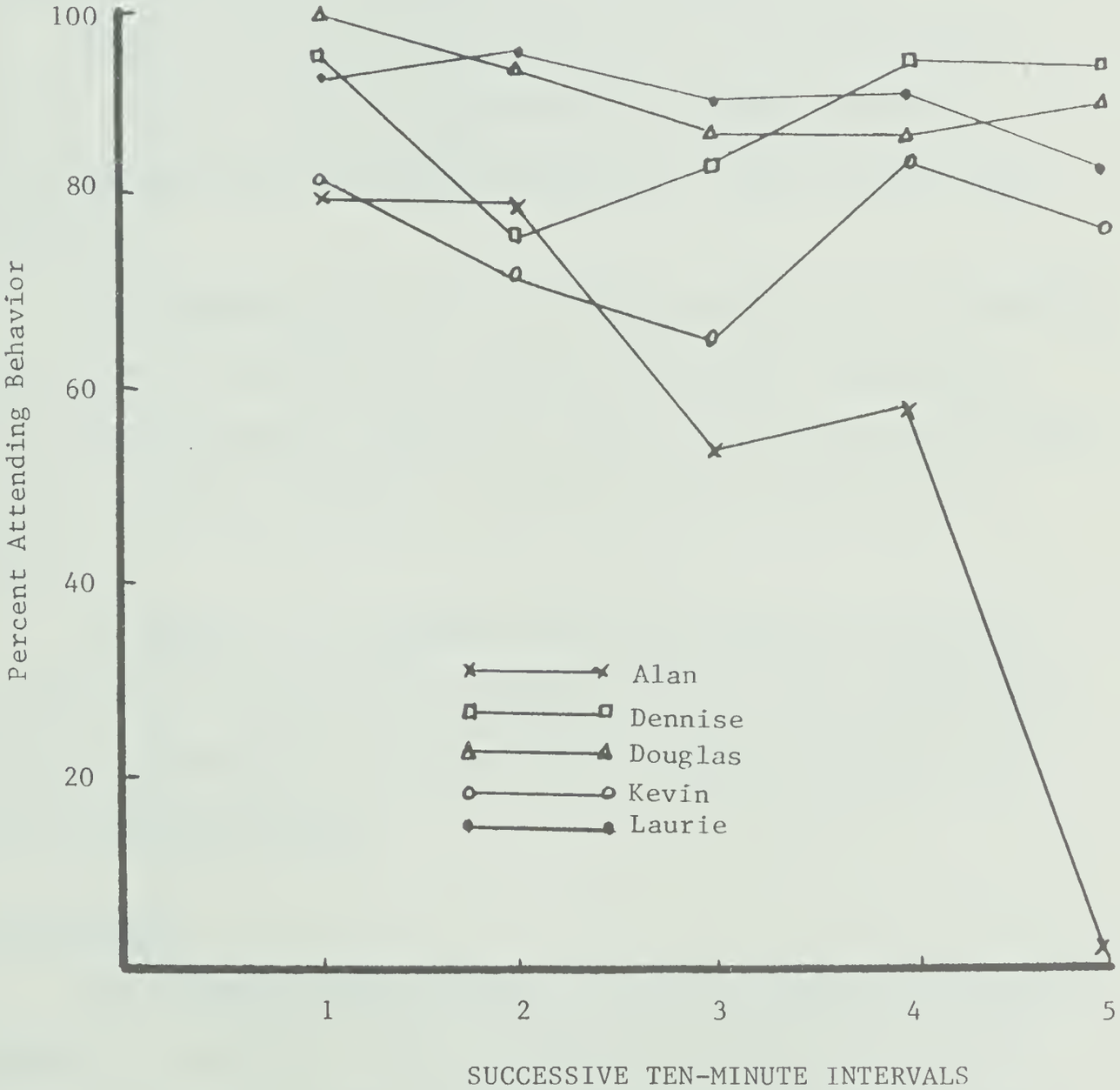

Fig. 1. Percent attending behavior of the experimental group in successive ten-minute intervals over a period of one hour of continuous training.

(Kevin) dropped to about 65% during the third interval, but recovered to about the 80% level during the fourth and fifth intervals.

The fifth subject (Alan) remained attentive (80%) during the first twenty minutes of training. However, the extended period of training produced a decrease in attending behavior to about the 60% level during the third and fourth intervals. A further decrease occurred during the final interval to a low point of 2%.

Similar measures were also taken on the comparison group in order to provide a basis for comparing the attending behavior of the two groups under the training conditions. These data are shown in Figure 2.

The comparison group did not attend as well as the experimental group in any of the 10-minute observation intervals. The subjects in the comparison group attended over 80% of the time during the first interval, but slowly decreased to 58% during the last observation period.

In summary, it is evident from the data that the procedures were effective in maintaining attending behavior in the experimental subjects. As expected, the comparison group did not attend as well as the experimental group.

Error Analysis

The procedures were designed to keep the number of incorrect responses at a minimum. Table 4 indicates the percentage of error (incorrect) responses made by the members of the experimental group at each step (i.e., Table 3) in the training program. These data were based on performance over the 40 training sessions.

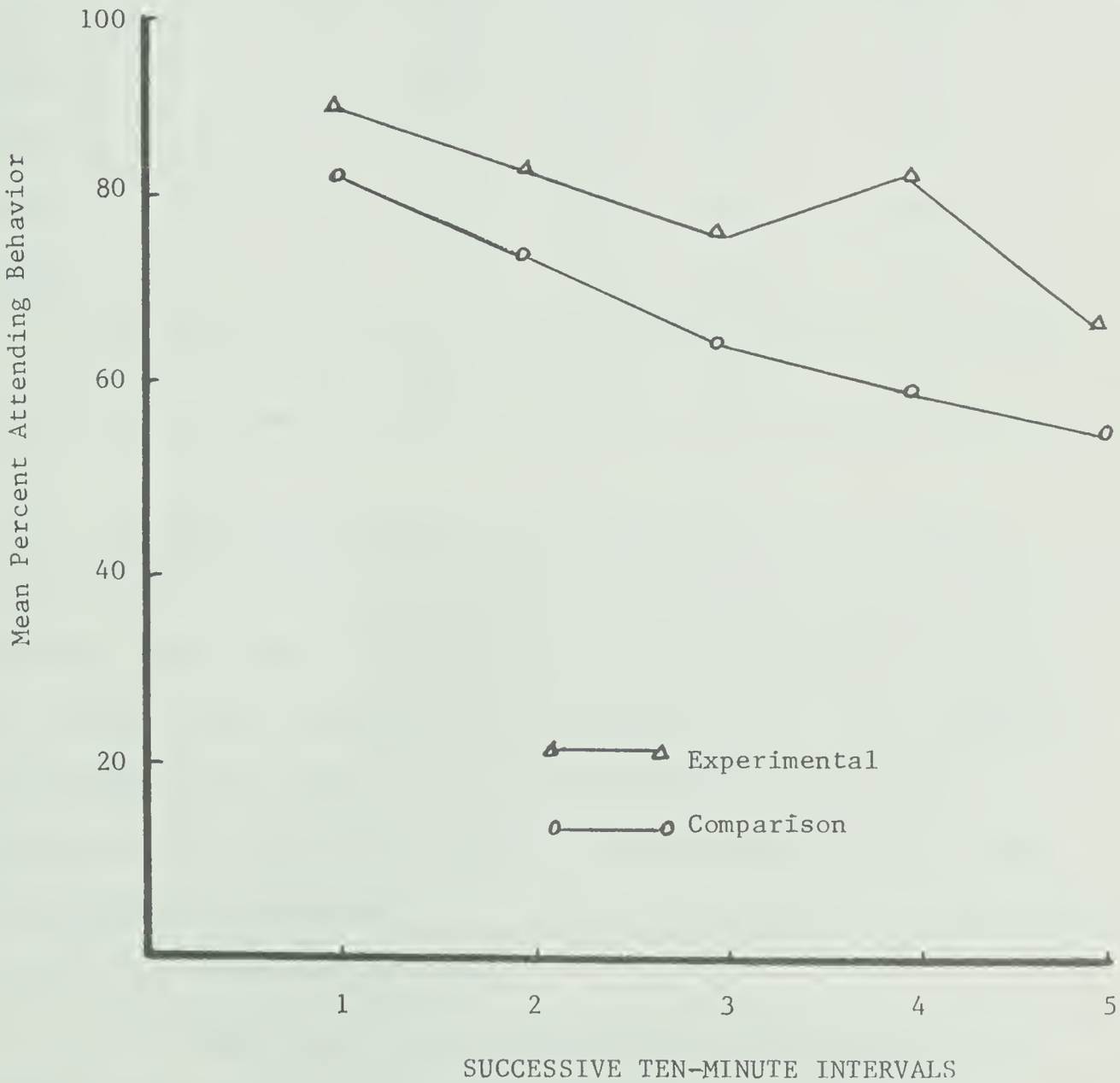

Fig. 2. Mean percent attending behavior for the experimental and comparison groups in successive ten-minute intervals over a period of one hour of continuous training.

TABLE 4

Percentage of Error Responses Made by Members of the Experimental Group at Each Step in the Training Program

	Percentage of incorrect responses				
Subject	Step: 1	2	3	4	Average
Alan	0	8.0	14.2	13.2	9.0
Dennise	0	16.0	14.9	13.8	11.2
Douglas	0	9.2	10.2	12.2	7.9
Kevin	0	14.4	18.0	23.0	13.8
Laurie	0	5.9	7.0	9.0	5.5
$\bar{X}$	0	10.7	12.9	14.4	9.5

In general, the steps became progressively more difficult, as is indicated by the mean percentage of incorrect responses which occurred at each step. The average percentage of incorrect responses over the four steps in the training program was 9.5%. Some variation among subjects was evident. The average percentage of incorrect responses made by individual subjects ranged between 5.5% and 13.8%. In summary, it appears that the procedures were effective in maintaining a low rate of incorrect responding.

The investigator was also interested in determining if the number of incorrect responses increased as the training stimuli became progressively more difficult. To answer this question, records were kept of incorrect, correct, and total trials to criterion for

each new group of stimuli taught. The mean number of responses for 15 successive blocks of four training stimuli is presented in Figure 3.

It is significant to note that, even though the stimuli became increasingly more difficult, the frequency of incorrect responses did not increase accordingly. There is some evidence to indicate that the opposite effect occurred: the frequency of incorrect responses *decreased* during the later training sessions. This might be interpreted as a function of learning set. Appendix A presents the data for the individual subjects.

Acquisition

Acquisition was defined as the successful completion of step four in the program. New stimuli were taught in groups of four; each group of four stimuli was considered *learned* once criterion (acquisition) had been reached.

Figure 4 presents the mean acquisition curve for the experimental group in five session intervals over the 40 training sessions. The graph shows that new stimuli (words) were being acquired or learned at an average rate of two per session. The relationship between the number of words learned and the number of training sessions appears to be approximately linear.

Individual subjects varied to some extent in the rate at which new stimuli were learned. Individual acquisition curves are presented in Appendix C for the subjects in the experimental group.

Since session length varied to some extent between subjects, it is also meaningful to look at acquisition in terms of minutes

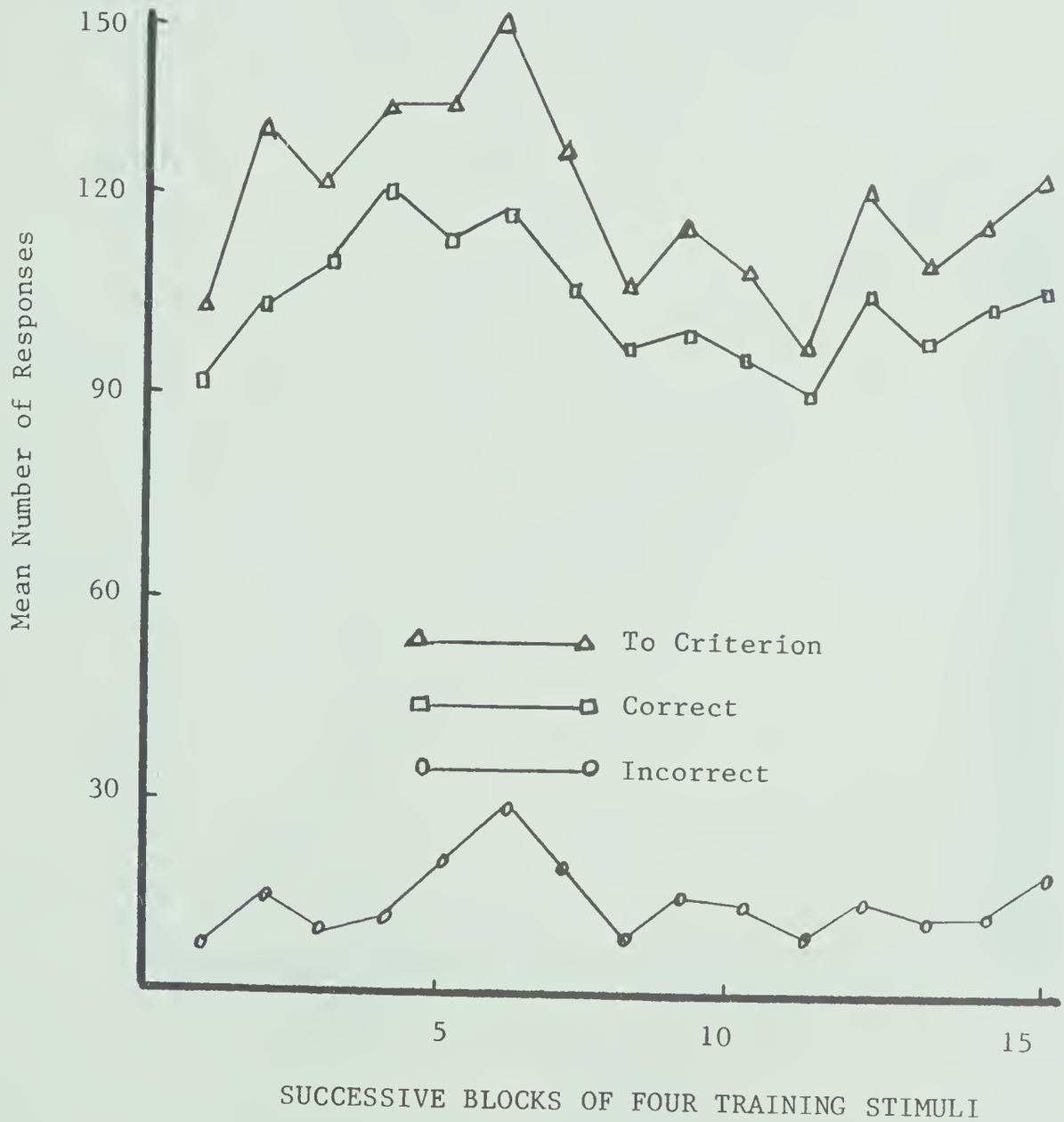

Fig. 3. Mean number of incorrect, correct, and total trials to criterion for fifteen successive blocks of four training stimuli.

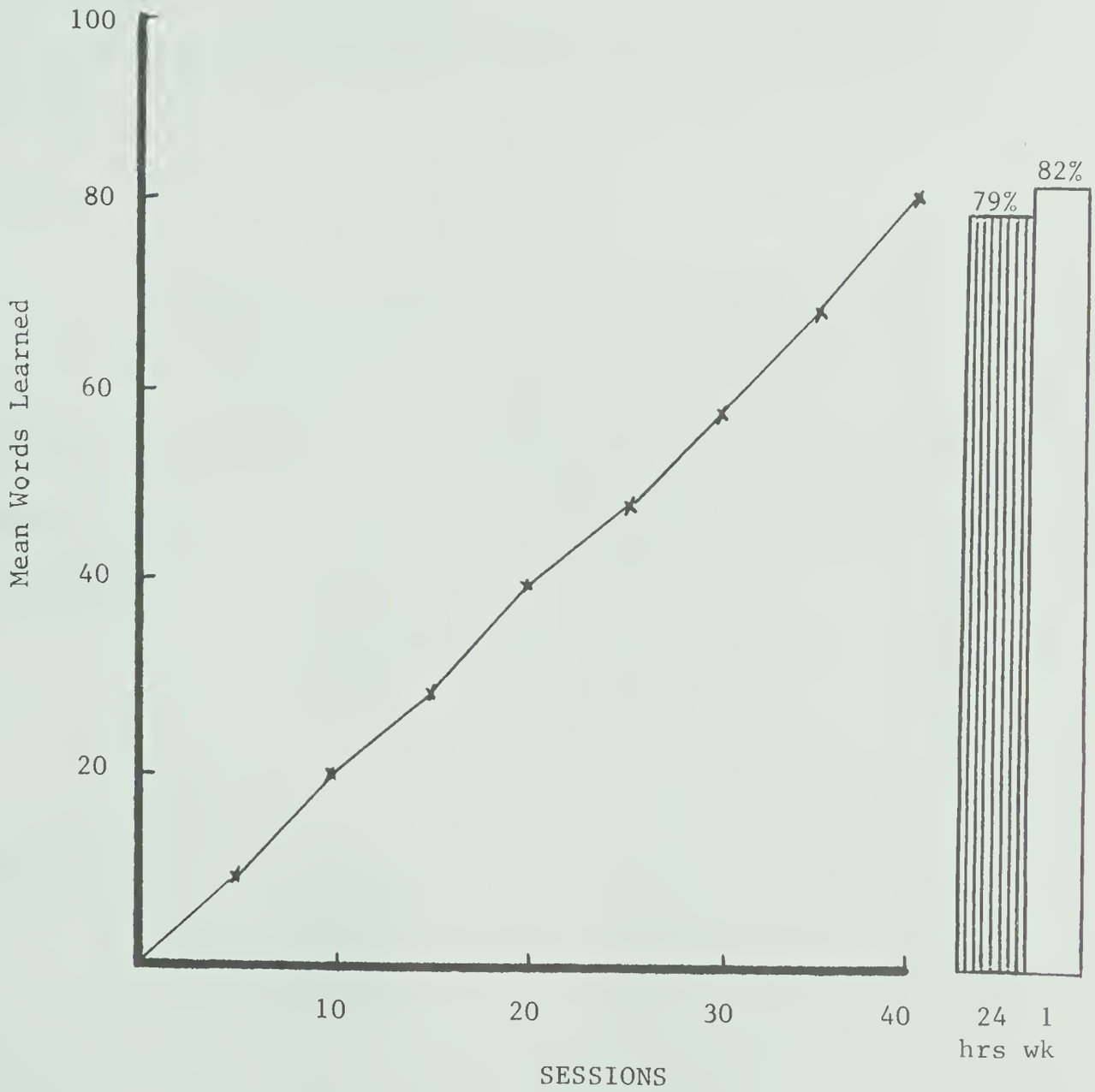

Fig. 4. Mean acquisition curve in five session periods for members of the experimental group. Mean percent retained following intervals of 24 hours and one week after acquisition is also shown.

spent in training (Appendix B). Viewed from this perspective, Laurie was the fastest learner, since she required an average of only 5.9 minutes of training for each stimulus. Laurie was followed in turn by Douglas (7.3), Dennise (8.2), Alan (8.4) and Kevin (11.1).

To control for acquisition gains which might have resulted from the regular classroom experiences of the experimental subjects, the experimental design provided for pre-and posttest measures on both the experimental and comparison groups. These results are presented in Table 5.

TABLE 5

Summary of Pretest and Posttest Scores for the Experimental and Comparison Groups

Group	Subject	Pretest*	Posttest**
Experimental	Alan	60	105
	Dennise	74	172
	Douglas	116	222
	Kevin	54	113
	Laurie	104	203
		$\bar{X}$ = 82	$\bar{X}$ = 163
		SD = 24	SD = 47
Comparison	Cathy	98	109
	Collette	65	65
	Jimmy	150	151
	Marc	17	25
	Peter	40	75
		$\bar{X}$ = 74	$\bar{X}$ = 85
		SD = 47	SD = 43

*p = .345

**p = .028

The Mann-Whitney U Test (Siegel, 1956, p. 116) was used to compare the performance of the two groups. The difference in pretest scores for the two groups was not significant ($p = .345$), whereas the experimental group performed significantly ($p = .028$) better on the posttest. On the basis of the experimental findings, it is evident that differences existed between the two groups on posttest performance.

Thus, one may conclude from the data that the gains made by the experimental group were due to the individualized training.

Retention

A further question of interest was whether the subjects, after achieving the criterion of learning, would maintain appropriate responding after a lapse of time following tutoring. To answer this question, retention was checked for each item (stimulus) after intervals of 24 hours and one week following acquisition. An item was considered *retained* if the subject responded appropriately to it on two consecutive trials during the test. A summary of the retention tests is shown in Table 6.

On the whole, retention remained at a high level. Retention, as checked 24 hours after acquisition, ranged between 68% and 88%. The results one week following acquisition ranged between 61% and 96%. The posttest scores also provided additional evidence to indicate that a significant portion of the learning was retained over an extended period of time.

TABLE 6

Summary of Retention as Checked 24 Hours and One Week After Acquisition

	24 hours		one week	
Subject	N*	Retention	N*	Retention
Alan	48	79%	24	96%
Dennise	60	68%	56	61%
Douglas	64	83%	41	79%
Kevin	56	75%	43	79%
Laurie	84	88%	44	95%

*Number of stimuli checked

Experimental Probes

Primary reinforcement. Following 15 sessions of training, an attempt was made to assess the effect of withdrawing the primary (food) reinforcement for a period of 5 sessions. A "reversal" technique (Baer, Wolf, & Risley, 1968) was used whereby a baseline period of training was given during which both primary and secondary reinforcements were provided. Following this period, five sessions of training were given where primary reinforcement was not used. Primary reinforcement was then reintroduced for subsequent training sessions. The results of these manipulations are presented in Figure 5.

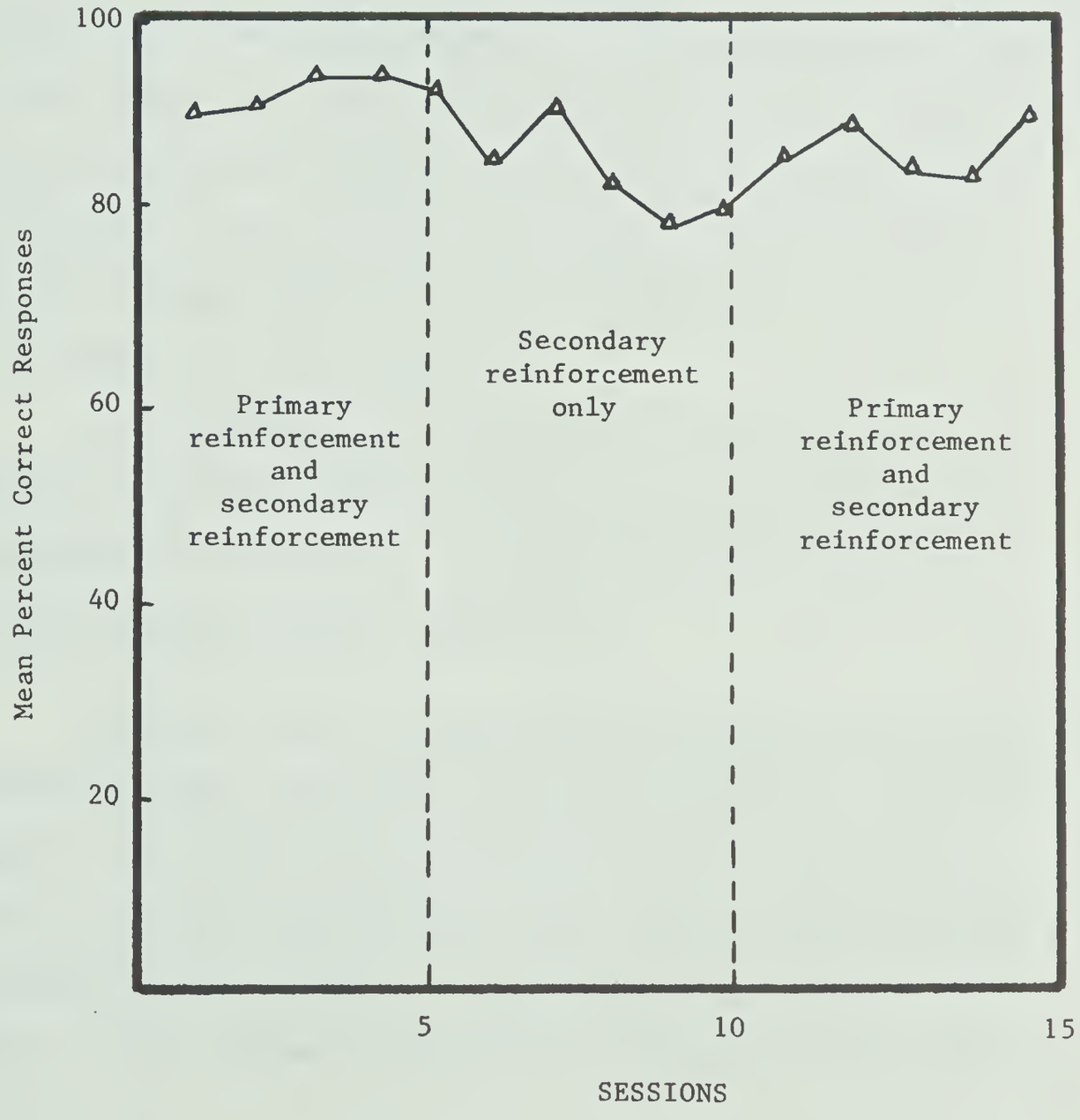

Fig. 5. The effect of withdrawing primary reinforcement over a period of five training sessions.

The mean level of correct responding was over 90% during the baseline period during which both primary and secondary reinforcement were used. The removal of primary reinforcement produced a decrease in level of correct responding to 78%. The reintroduction of primary reinforcement resulted in an improvement in level of correct responding to a mean of 86%.

It is evident from Figure 5 that the level of correct responding remained fairly high even though no food was being used as reinforcement. It would appear that other reinforcers served to maintain appropriate responding during the reversal period. For example, praise given by the tutors or the secondary reinforcing value of the tutor's presence, may have provided sufficient reinforcement to maintain a high level of correct responding.

It is significant to note that both tutors reported that training was greatly facilitated when both primary and secondary reinforcement were provided. Individual differences among the subjects were also observed (Appendix D).

Transfer. A test for generalization effects was administered immediately before, and after, training on each group of four PPVT stimuli. Five trials were given for each of the stimuli tested, with rearrangement following each trial. The test items consisted of colored pictures, similar to the objects pictured on the PPVT plates. Table 7 presents the results of the generalization tests.

TABLE 7

Summary of Tests for Generalization Effects

Subject	Number of stimuli checked	% correct responses	
		pretest	posttest
Alan	22	42	85
Dennise	37	44	47
Douglas	20	80	85
Kevin	39	42	63
Laurie	11	47	80

All of the subjects showed improved performance on the colored test items following training on the PPVT stimuli. Three subjects (Alan, Douglas, Laurie) responded appropriately over 80% of the time on the posttest. The youngest subject (Dennise) showed only very slight improvement.

It is significant to note that the pretest was conducted at the beginning of the session while the posttest was conducted immediately after the completion of step four, which usually occurred after a considerable amount of time spent in training had elapsed. This variable may have depressed performance on the posttest to some extent. However, in view of the considerable improvement in performance demonstrated by four of the five members of the experimental group, there is evidence to support the conclusion that some transfer of training occurred as a consequence of training on the PPVT stimuli.

Following the 40 training sessions, two additional probes were conducted to determine if generalization occurred as a result of training. An analysis of posttest performance for members of the experimental group produced a list of items for each subject consisting of stimuli which had been both trained *and* scored correct on the posttest.

The first individualized test consisted of similar non-colored stimuli and the second, of similar colored stimuli. Three trials were given for each item. Credit was given if an item was responded to appropriately on two of the three trials. For testing purposes, items were displayed in groups of four, and stimuli were randomly rearranged after each trial. Figure 6 presents the results of the two tests.

As indicated in Figure 6, four of the five subjects responded appropriately to over 75% of the test stimuli. In most instances, the colored pictures appeared to be less difficult for the subjects than the black and white test items.

Since pretest data were not available, it is difficult to make any conclusive statements with respect to why the subjects performed so well on both these tests. However, the results would appear to support the cautious conclusion that successes on the generalization tests were due, in part, to the training program.

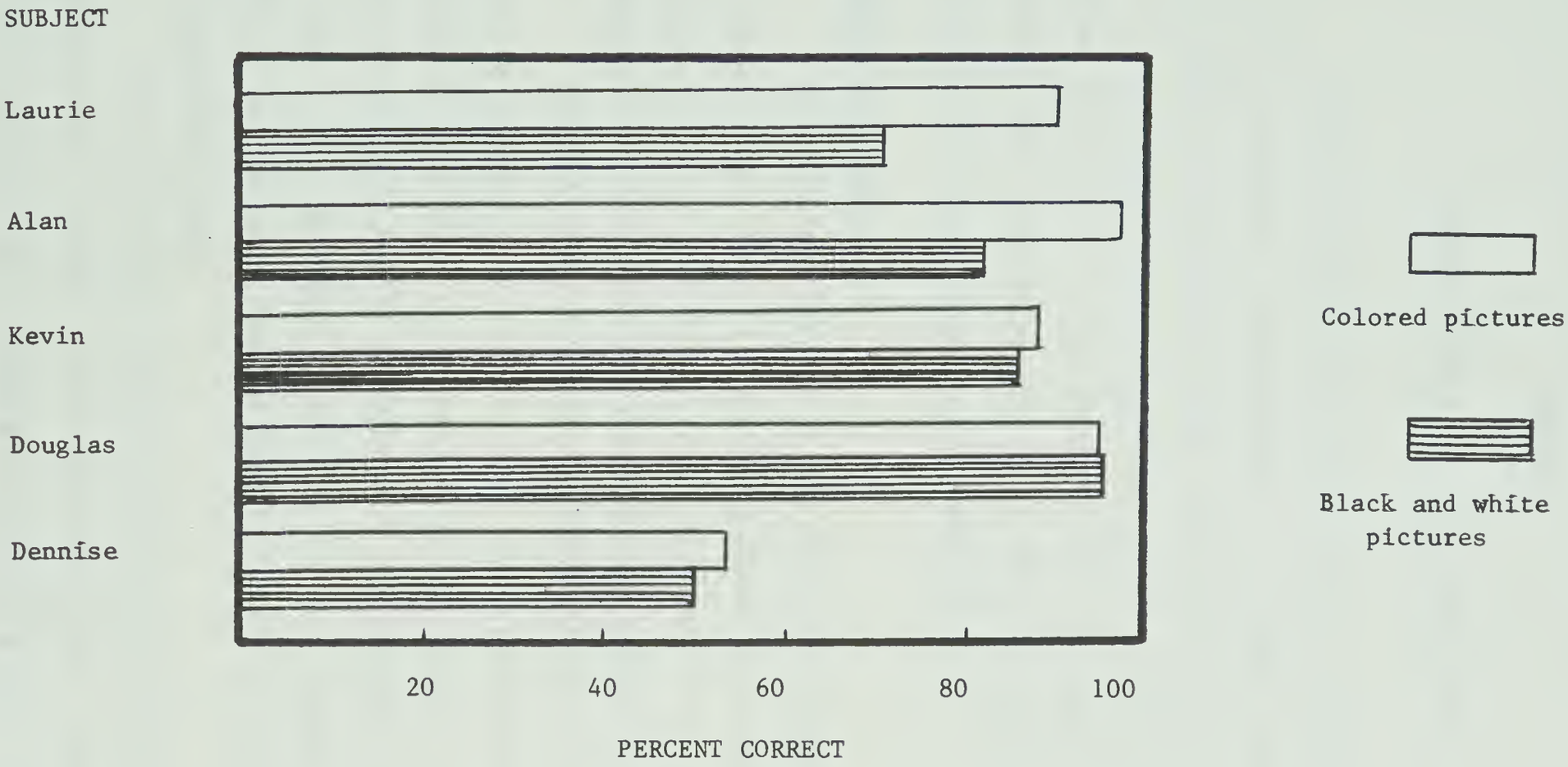

Fig. 6. Results of two tests for generalization effects. One test consisted of similar black and white pictures. The second test consisted of similar colored pictures.

Chapter 6

Summary, Discussion, and Implications

In this chapter, the purpose, method, and major findings of this investigation are summarized. Following this summary, a more general discussion of results and implications is presented. It is recognized that the exploratory nature of this investigation imposes limitations on the extent to which generalization is feasible. However, some tentative extensions in terms of implications for education and future research are suggested.

Summary of Results

The principal purpose of the present investigation was to devise and to evaluate the effectiveness of an integration of programmed instruction and operant techniques in developing receptive vocabulary in young, non-institutionalized mongoloid children.

To achieve this purpose, a sample of ten subjects was drawn from the population of children with Down's syndrome (mongolism) presently enrolled in the beginning "sense training" program at the Winnifred Stewart School in Edmonton. The subjects were equated in pairs on the variables of sex, IQ, MA, and language age (LA). Subjects in each pair were assigned by chance to the experimental or comparison group.

The experimental subjects were given 40 sessions of individualized tutoring over an 8-week period. New stimuli were taught in groups of four in a carefully programmed sequence of small steps devised

to keep the number of error responses at a minimum. Training provided for systematic reinforcement in the form of small bites of food or praise from the tutors contingent upon appropriate responding. The program incorporated parent education and cooperation.

Continuous, objective measures were taken in all training sessions and tests were applied before, during, and after treatment. Both individual and group control methods were attempted.

Procedural effectiveness was assessed in terms of: attending behavior, levels of correct and incorrect responding, acquisition, and retention. In addition, an experimental probe was conducted to assess the effect of withdrawing primary reinforcement for a period of training. Attempts were also made to identify generalization effects related to training.

Analysis of the results indicated that an integration of programmed instruction and contingency management techniques had a significant positive effect on the learning of receptive vocabulary by the mongoloid children in the experimental group.

Discussion of Results

Attending behavior. The data clearly indicate that young mongoloid children persevere in a learning task if learning conditions are appropriately arranged and if sufficient reinforcement is provided. Thus, as Michael (1967) has pointed out, the common view that prolonged and intense training is not possible for these children because of their limited attention span requires re-examination. In answer to the short attention span hypothesis, Michael (1967)

comments: "There is no reason to suppose that the mentally retarded will show a degree of persistence in reinforced behavior less than that of rats, pigeons, and normal humans for that matter (p. 87)."

The experimental findings in the present study with respect to attending behavior are in essential agreement with the views expressed by Stuart (1969). Stuart has strongly suggested that in order to develop and sustain the interest of low-functioning children, it is necessary to modify both the content of school curricula and the means by which it is presented.

In summary, the procedures followed in the present investigation were effective in maintaining attending behavior in the experimental subjects for prolonged periods of training. Moreover, the comparison of the attending behavior of the two groups has provided evidence to suggest that, the training changed, in a positive way, the attending behavior of the experimental subjects.

Acquisition. Subjects in the experimental group varied to some extent in the rate at which they acquired appropriate responses to new stimuli. However, the data indicate rather conclusively that these children can acquire receptive vocabulary efficiently and well, if the presentation and feedback conditions are appropriate.

Retention. The evidence of this study showed that the experimental subjects could maintain appropriate responding to the training stimuli for extended periods following acquisition. This may be attributed, in part, to the repetition and overlearning which were an integral part of the program design. Of greater importance is the finding that, given appropriate learning conditions,

the mongoloid children in this study demonstrated clearly that they could acquire and retain receptive vocabulary.

Error analysis. The procedures were designed to keep the number of incorrect responses at a minimum. To achieve this end, presentation of stimuli was carefully controlled and systematic positive reinforcement was given for correct responding.

Malpass (1967) has indicated that although some programs for normal children aim for no more than a 5% error rate, such a low error rate is difficult to achieve with retarded children. He states that a program that yields an average error rate lower than 15% is a more realistic aim with retarded children.

The results from this investigation indicate that, on the average, all of the experimental subjects made fewer than 15% error responses over the four steps in the program. Therefore, it may be concluded that the procedures employed were adequate in this respect.

Experimental probes. In the investigator's opinion, the experimental probe conducted to determine the effect of withdrawing primary reinforcement did not clearly indicate the utility of using food rewards. The dependent variable (percentage of correct responses) was not markedly affected by the manipulation of the primary reinforcement. It is highly probable that the training, despite removal of food rewards, provided sufficient positive reinforcement to maintain a high level of appropriate responding. For example, the tutor's presence, provision for secondary reinforcement, and the programming of stimuli probably all had a reinforcing effect.

Subjective observation of the training sessions indicated that training attempts were greatly facilitated when food was used. Appendix D provides evidence to this effect. In Appendix D, the tutors describe the subjects' behavior under the "no primary reinforcement" condition. (Perhaps a more sensitive dependent variable would have been the subjects' attending behavior under the different treatments.)

In summary, it is important to stress that the use of primary reinforcement (enhanced by mild deprivation) was considered to be an integral and necessary aspect of the training procedure.

The experimental probes to examine generalization effects were somewhat restricted by the lack of suitable materials for testing purposes. However, the available evidence lends some support to the claim that stimulus generalization did occur as a consequence of training.

Other considerations. The data do not clearly reflect the decrease in frequency of deviant or undesirable behaviors which occurred as training progressed. During the first five training sessions, deviant behaviors, such as leaving the chair, grabbing the food, hitting, and not paying attention were frequent. The following techniques were utilized to bring these maladaptive behaviors under control: (1) The tutors were instructed to extinguish behaviors such as leaving the chair by physical intervention, preferably before the act got under way. (2) Short time-outs, where the tutor looked down and away, were programmed contingent upon mild deviancy, such as inattention. (3) More serious deviancy, such as temper tantrums or refusal to

respond, were occasions for extended periods of time-out (5 minutes), where the tutor left the cubicle, taking the apparatus and rewards with her.

It was felt by the investigator (and tutors) that the combination of intervention and time-out procedures were more effective in bringing deviant behavior under control than simply ignoring maladaptive behaviors. It should also be noted that the small steps in the program maximized opportunities for success. Consequently, the subjects received numerous rewards for behaviors which were incompatible with deviancy.

Implications for Education

The data in the present investigation permit the conclusion that an integration of programmed instruction and contingency management techniques had a significant positive effect on the learning of receptive vocabulary by the mongoloid children in the experimental group.

The investigator is inclined to agree with Blackman (1967) when he says that educators should turn their attention to the development of carefully defined instructional systems designed to accomplish carefully considered and highly delineated educational objectives. As Blackman states:

> The development of education as a science rather than as an art form will be wholly dependent on concrete and measurable statements of educational objectives coupled with the highly specific delineation of instructional procedures leading toward those objectives (p. 8).

The present study represents a modest and tentative step toward this goal.

The mongoloid children in this investigation demonstrated clearly that they could respond to instruction which provided for contingencies and programming of behavioral goals. On the basis of the present experimental evidence, it is suggested that further investigation is required to validate the assumption that the mongoloid child cannot benefit from instruction because of innate or organic factors.

Concomitant with the problems of developing new and refined instructional procedures, there exists the persistent problem of obtaining sufficient trained personnel to implement effective intervention programs. The use of parents to effect desired behavior changes is one obvious possibility which appears to hold considerable promise (Hawkins, Peterson, Schweid & Bijou, 1966; Risley & Wolf, 1964; Terdal & Buell, 1969; Wahler, Winkel, Peterson, & Morrison, 1965; Weiner, 1969; Wildman, 1965).

It seems reasonable to suggest that sub-professional persons, such as parents, could effectively conduct daily home-training sessions if they were provided with effective materials, adequate training, and close consultation. This approach would help circumvent the need for expensive professional time.

The parents of the children in the present investigation were interested and cooperative throughout. They regularly attended seminar discussions held during the course of the investigation and cooperated by providing their children with only a light breakfast to induce a mild state of deprivation. The potential of parents of retarded children as behavior modifiers would appear to be one exciting possibility for future research. For example, the procedures

and apparatus employed in this investigation appear suitable for use by parents.

Implications for Research

The rationale of the experimenter in the present study was in essential agreement with several investigators (Bijou, 1963; Birnbrauer, 1966; Gallagher, 1969; Guess et al., 1970; Hollis & Gorton, 1967; Homme et al., 1968; Skinner, 1968; Staats & Staats, 1964). These investigators have all indicated the need for more research concerned with applying established behavioral principles to the education and training of retarded individuals.

This investigator also concurs with Birnbrauer (1966) when he says:

> These cycles which tend to maintain behavioral deficits or worsen them must be interrupted in order to determine what the potential of each child may be. Whether effective and economically feasible training environments can be designed is an empirical question (p. 99).

It is clearly evident that we now have operational procedures applicable to building training programs. As Gallagher (1969) puts it: "We need the kind of research that would investigate what young retarded children are capable of accomplishing, if we think of them as 'potentially normal' and not permanently retarded (p. 55)."

In summary, the investigator sees a great need for more applied research with young low-functioning children in the natural environment, where one attempts to build, in systematic fashion, the skills and knowledge required for social competency.

Homme et al. (1968) have stated the case well when they

say:

> We may have sufficient technology--here and now--to be able to guarantee that, given a physiologically normal human being, and given control of his reinforcement contingencies and stimulus conditions, we can shape him into a superior organism . . . We have the technology for installing any behavior we want. The problem now is, what behaviors do we want installed (p. 431).

How successful the application of such technology could be with mongoloid and other physiologically impaired children remains an open question. However, the writer is inclined to agree with Skinner (1968) when he says:

> Education is perhaps the most important branch of scientific technology. It deeply affects the lives of all of us. We can no longer allow the exigencies of a practical situation to suppress the tremendous improvements which are within reach. The practical situation must be changed (p. 19).

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APPENDICES

Appendix A

Summary of Individual Performance During Training

Appendix A

TABLE 8

Summary of Incorrect, Correct, and Total Trials to Criterion for Successive Blocks of 4 Training Stimuli (Alan)

Block	Incorrect responses	Correct responses	Total trials to criterion
1	17	109	126
2	14	123	137
3	28	193	221
4	24	186	210
5	7	96	103
*6	37	121	158
*7	48	106	154
8	22	106	128
9	9	90	99
10	1	80	81
11	0	80	80
12	4	81	85
13	3	81	84
14	6	87	93
15	27	107	134
16	1	80	81
$\bar{X}$	15.5	107.9	123.4
SD	13.9	33.9	43.3

*Primary reinforcement removed

Appendix A

TABLE 9

Summary of Incorrect, Correct, and Total Trials to Criterion for Successive Blocks of 4 Training Stimuli (Dennise)

Block	Incorrect responses	Correct responses	Total trials to criterion
1	15	100	115
2	24	110	134
3	1	86	87
4	21	99	115
5	13	103	119
6	6	90	96
7	19	141	160
8	15	114	129
9	16	113	129
*10	2	81	83
*11	9	103	112
*12	17	113	130
*13	24	125	149
14	24	140	164
15	51	173	224
16	19	117	136
17	12	106	118
**18	8	95	103
**19	30	143	173
**20	9	92	101
**21	4	84	88
**22	9	95	103
$\bar{X}$	15.8	110.1	125.8
SD	101.8	22.2	32.4

*Primary reinforcement removed
**Review items

Appendix A

TABLE 10

Summary of Incorrect, Correct, and Total Trials to Criterion for Successive Blocks of 4 Training Stimuli (Douglas)

Block	Incorrect responses	Correct responses	Total trials to criterion
1	0	80	80
2	6	96	102
3	23	119	142
4	13	103	119
5	10	98	108
6	23	127	150
7	5	89	94
8	6	95	101
9	2	81	88
*10	2	84	86
*11	8	95	103
*12	39	163	202
13	20	113	133
14	25	136	161
15	7	97	104
16	6	83	89
17	8	103	111
**18	4	109	113
**19	4	90	94
**20	1	82	83
**21	4	82	86
22	2	84	86
$\bar{X}$	9.9	100.4	110.7
SD	9.7	20.4	29.6

*Primary reinforcement removed
**Review items

Appendix A

TABLE 11

Summary of Incorrect, Correct, and Total Trials to Criterion for Successive Blocks of 4 Training Stimuli (Kevin)

Block	Incorrect responses	Correct responses	Total trials to criterion
1	6	88	94
2	37	153	190
3	1	83	84
4	26	127	153
*5	73	190	263
*6	80	200	280
7	30	123	153
8	4	97	101
9	46	122	168
10	60	142	202
**11	12	99	111
**12	1	80	81
**13	7	95	102
14	6	88	94
15	7	84	91
$\bar{X}$	26.4	118.1	144.5
SD	26.2	37.2	62.7

*Primary reinforcement removed
**Review items

Appendix A

TABLE 12

Summary of Incorrect, Correct, and Total Trials to Criterion for Successive Blocks of 4 Training Stimuli (Laurie)

Block	Incorrect responses	Correct responses	Total trials to criterion
1	2	82	84
2	5	98	103
3	0	80	80
4	0	80	80
5	0	80	80
6	2	84	86
7	2	80	82
8	0	80	80
*9	8	96	104
*10	6	99	105
11	7	84	91
12	14	100	114
13	0	80	80
14	0	80	80
15	1	80	81
16	2	83	85
17	0	80	80
18	1	80	81
19	3	82	85
20	8	90	98
21	0	80	80
22	1	80	81
23	11	92	103
24	39	150	189
25	19	112	131
$\bar{X}$	5.2	88.9	93.7
SD	8.4	15.9	23.5

*Primary reinforcement removed

Appendix B

Summary of Training Sessions

Appendix B

TABLE 13

Summary of Training Sessions for

the Experimental Group

Subjects	Sessions	Trials	Correct responses	Errors	Min-utes	Number trained to criterion
Alan	40	2017	1767	250	570	68
Dennise	40	2765	2420	345	722	88
Douglas	40	2430	2212	218	647	88
Kevin	40	2157	1761	396	665	60
Laurie	40	2343	2212	131	590	100
$\bar{X}$	40	2342	2074	268	639	81
SD		248	265	94	54	16

Appendix C

Individual Acquisition Curves

Appendix C

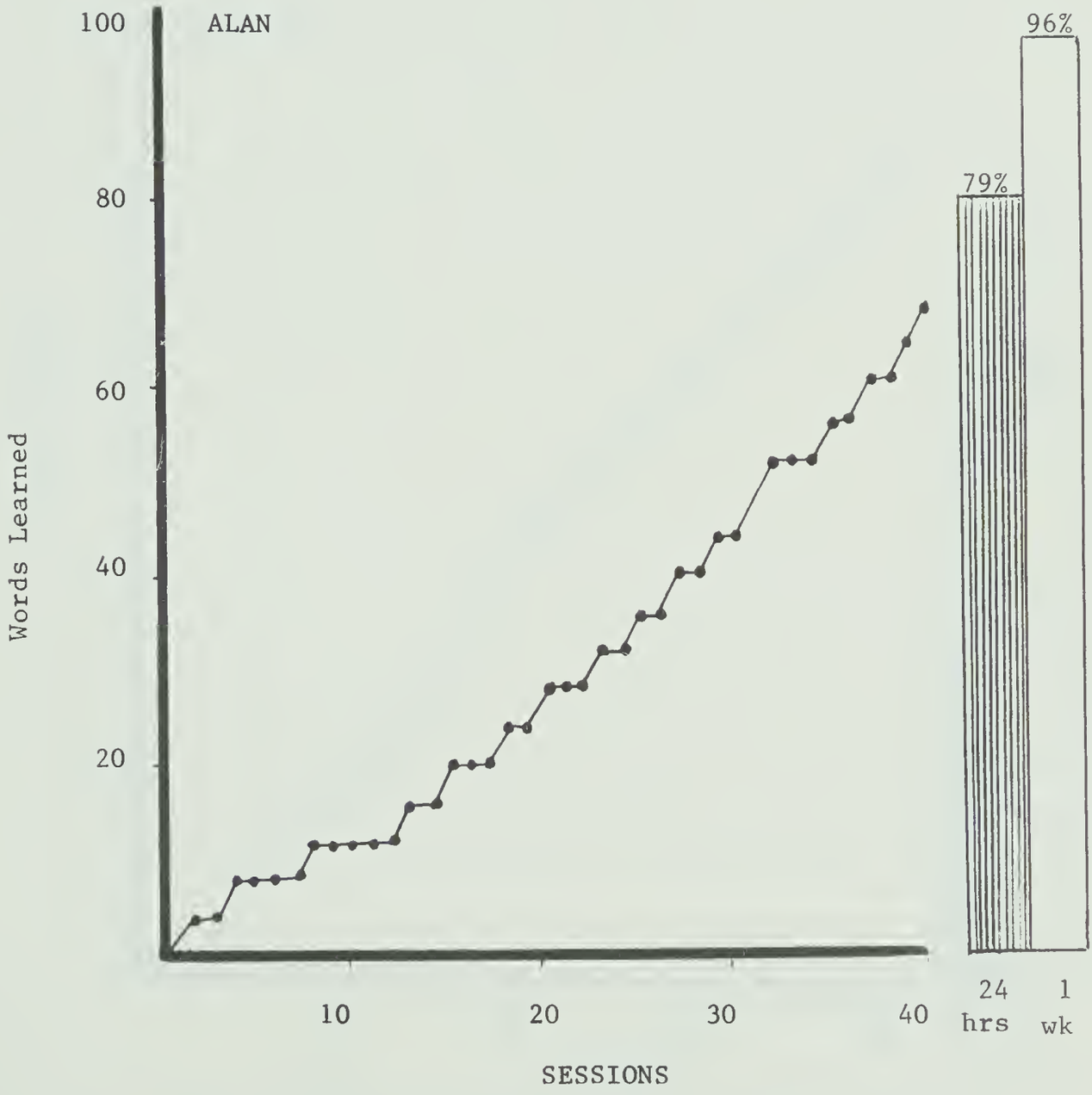

Fig. 7. Acquisition curve and retention following intervals of 24 hours and one week for one experimental subject (Alan).

Appendix C

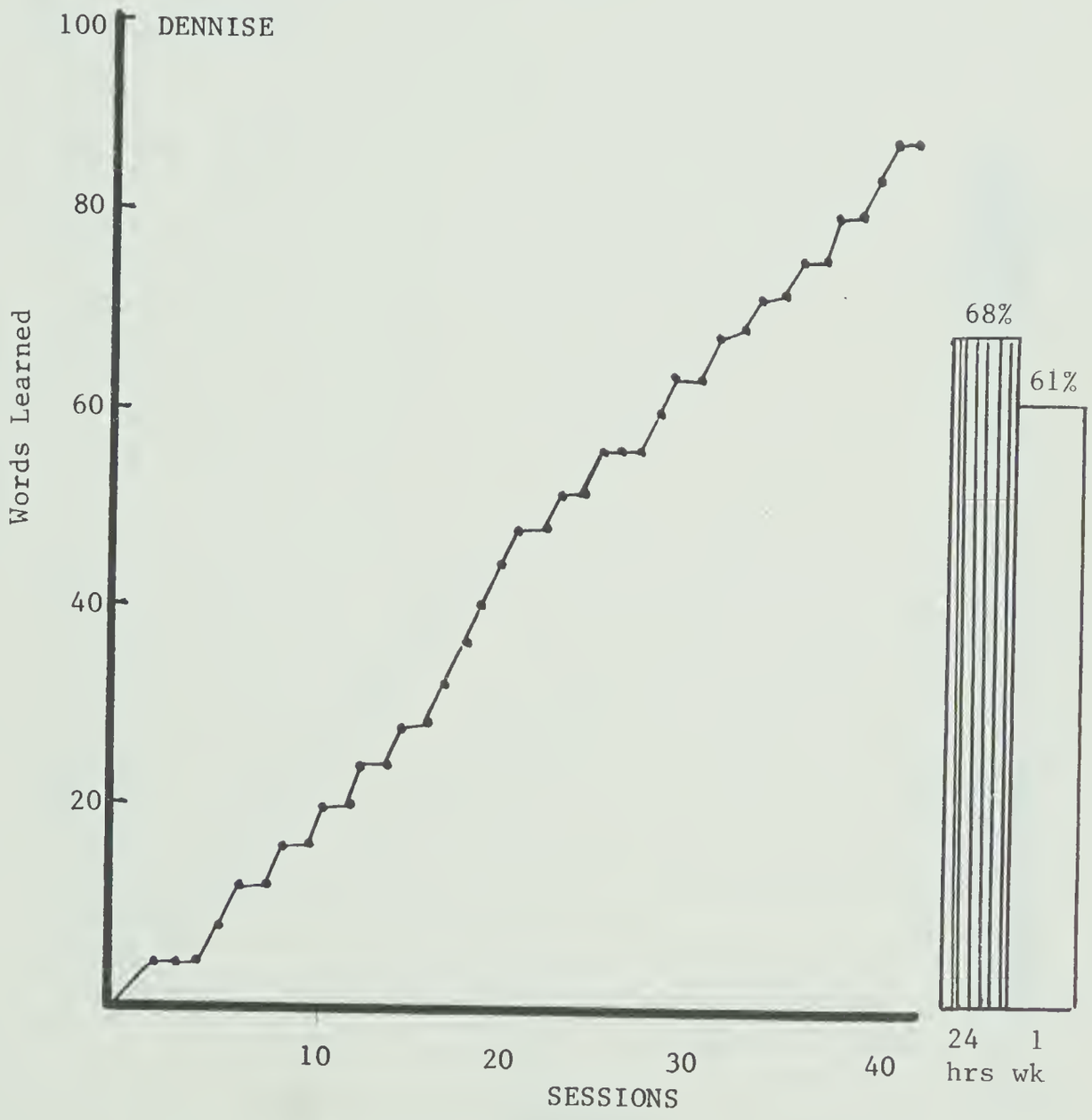

Fig. 8. Acquisition curve and retention following intervals of 24 hours and one week for one experimental subject (Dennise).

Appendix C

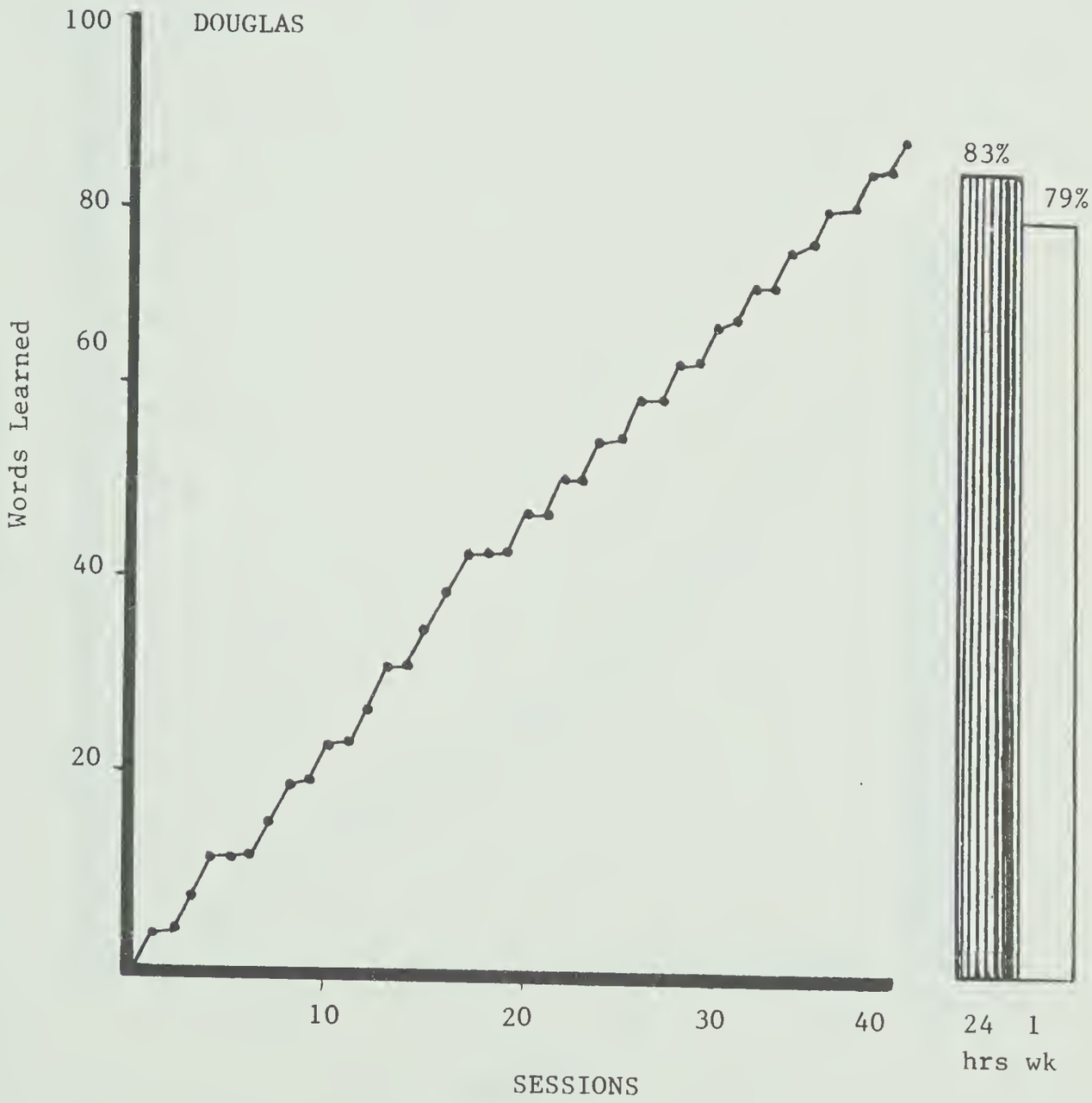

Fig. 9. Acquisition curve and retention following intervals of 24 hours and one week for one experimental subject (Douglas).

Appendix C

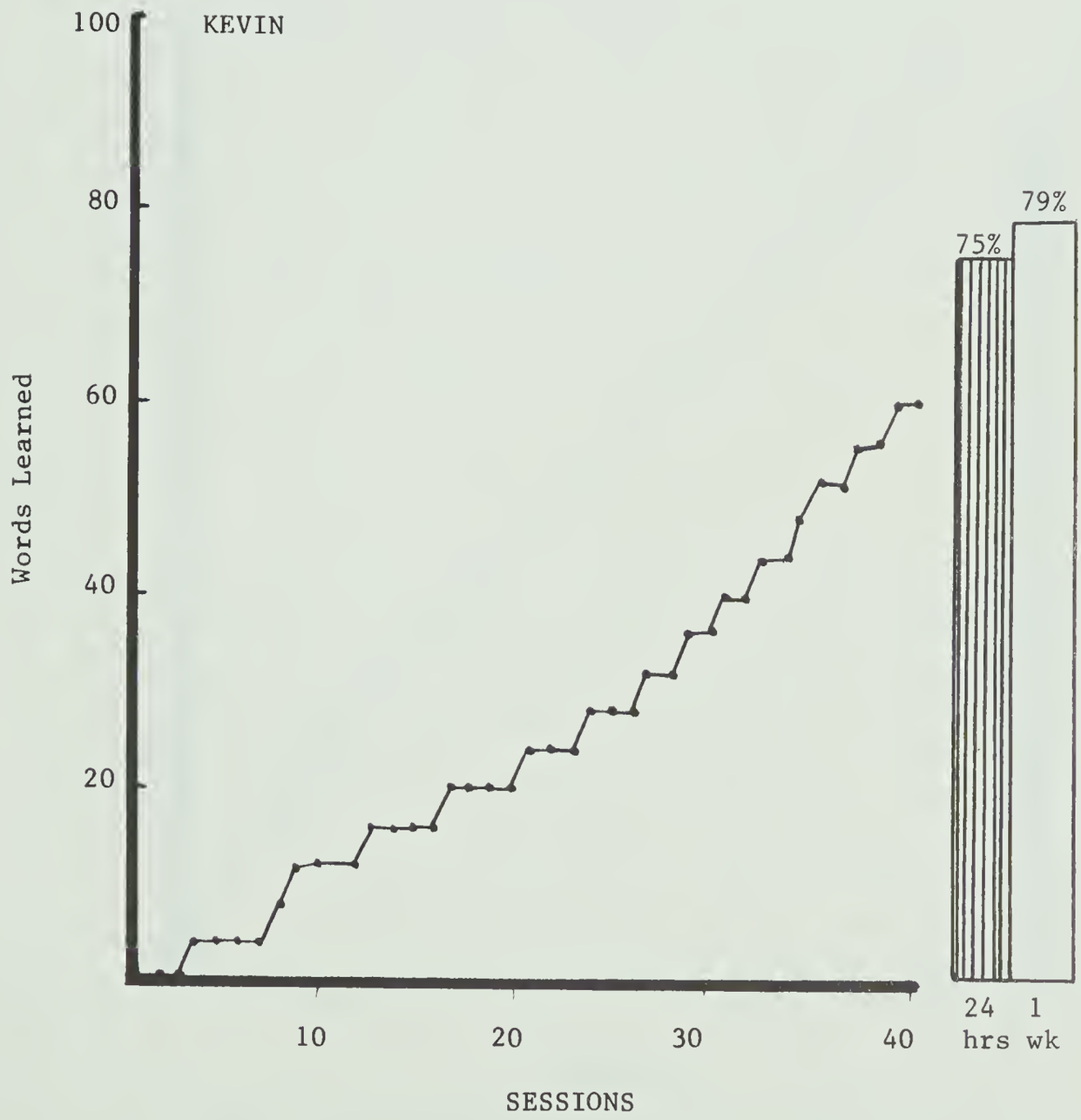

Fig. 10. Acquisition curve and retention following intervals of 24 hours and one week for one experimental subject (Kevin).

Appendix C

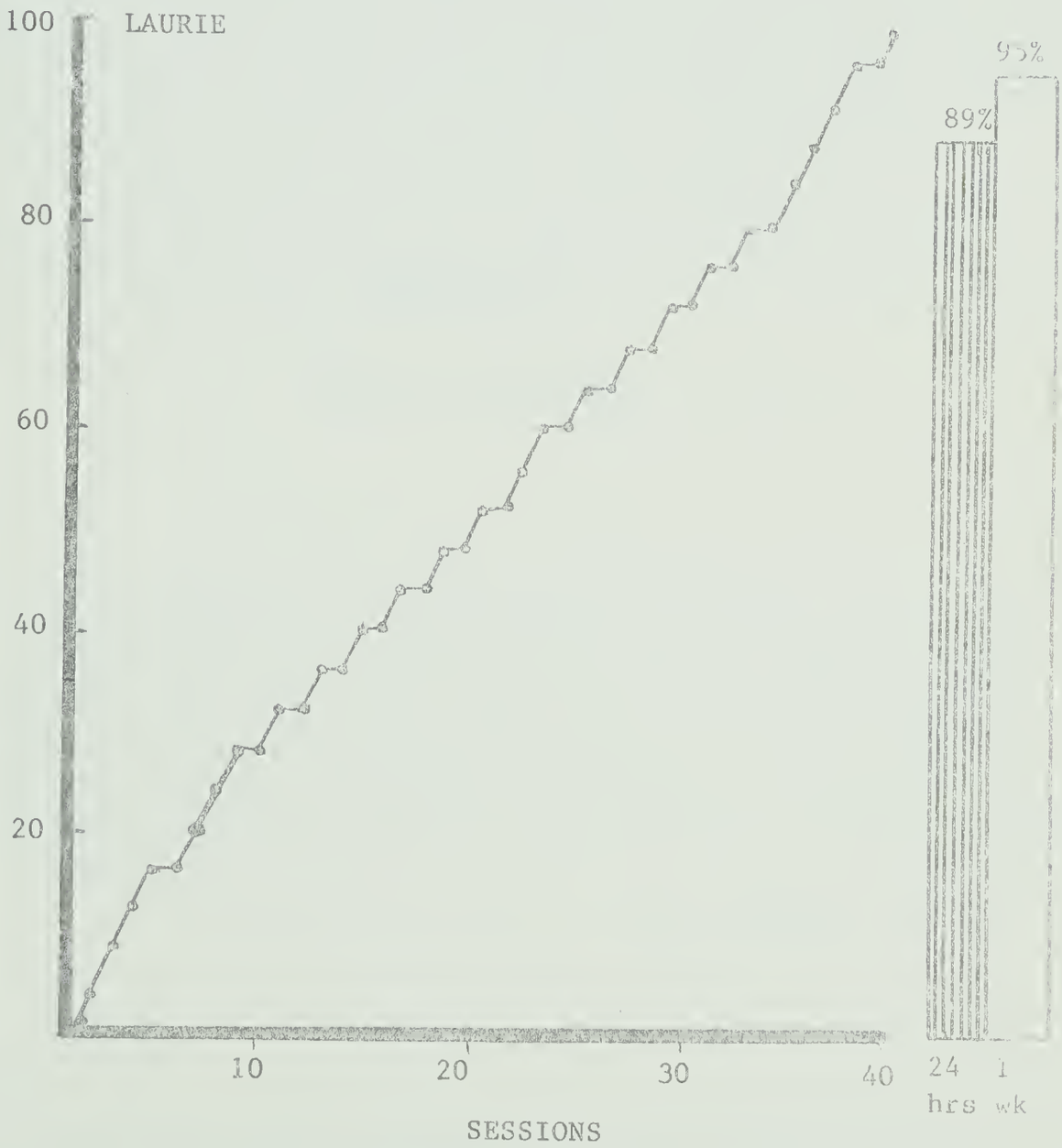

Fig. 11. Acquisition curve and retention following intervals of 24 hours and one week for one experimental subject (Laurie).

Appendix D

Reports from Tutors

Appendix D

Description of the subjects' behavior during training when primary reinforcement was not used as reported by the tutors.

Alan

> When training was carried out for 5 sessions without benefit of food rewards, Alan's behavior was markedly different. For the first two sessions he restricted himself to clapping and singing . . on the third session Alan made correct responses for the first two or three trials; then, when no food was forthcoming, he started singing, began to fidget, grabbed tutor's hair, put his feet up onto the table, etc. . . . for the fourth and fifth session Alan kicked the tutor, sat on his hands and looked at the window. His final move was to "look at his watch" and leap from his chair as though he had an important appointment.
>
> Sue Norton

Dennise

> When working without food (rewards), Dennise's characteristic behavior disappears. She immediately slows down to one or two trials per minute and makes many errors. A session will last only five to ten minutes and most of her time is spent fidgeting. She sits on her feet, plays with her sweater, takes off her shoes, gets up from her chair, plays with the display board and is generally distractible. She requires many more sessions to learn a block of cards and shows disinterest in new pictures.
>
> Sue Thompson

Douglas

> When food reward is withdrawn, Douglas becomes more quiet and misbehaves. He becomes extremely slow and disinterested. He plays with his glasses, kicks his feet, plays with the display board, and is generally disruptive. He points randomly and doesn't seem to care if he makes mistakes. Sometimes he will only point to one especially chosen picture, and begins

Appendix D

giggling every time he points to it. He seems relieved when the session is over.

Sue Thompson

Laurie

During the five sessions when no food was used as a reward, Laurie performed just as well as with the food. She was perhaps a little more inclined to talk and more easily distracted by noises outside the training booth, but was easily recalled to the task with a word, and would still complete three steps a day.

Sue Norton